FINAL

FEASIBILITY STUDY REPORT

Riverside Industrial Park
Superfund Site
Newark, New Jersey

July 20, 2020

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LIST OF ACRONYMS

Acronym	Definition
ABSd	Dermal Absorption Fraction
ACO	Administrative Settlement Agreement and Order on Consent
AEC	Area of Environmental Concern
ALM	Adult Lead Methodology
AMSL	Above Mean Sea Level
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirements
AST	Aboveground Storage Tank
ATSDR	Agency for Toxic Substances and Disease Registry
BBI	Baron Blakeslee, Inc.
BER	Baseline Environmental Risk
bgs	Below Ground Surface
BHHRA	Baseline Health Human Health Risk Assessment
Birdsall	Birdsall Services Group
BN	Base Neutral
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CCI	Chemical Compounds, Inc.
CEA	Classification Exception Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
cm/s	Centimeter per Second
COC	Chemical of Concern
COEC	Chemical of Ecological Concern
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CRS	Cultural Resource Survey
CY	Cubic Yard
DASRAT	Development and Screening of Remedial Alternatives Technical
Davion	Davion Inc.
DCE	Dichloroethene
DER	Declaration of Environmental Restriction
DNAPL	Dense Non-Aqueous Phase Liquid
ECRA	Environmental Cleanup Responsibility Act
EPC	Exposure Point Concentration
EPH	Extractable Petroleum Hydrocarbon
ESC	Ecology Screening Criteria
ESV	Ecological Screening Value
Federal	Federal Refining Company

Acronym	Definition
FEMA	Federal Emergency Management Agency
First Environment	First Environment, Inc.
FS	Feasibility Study
Frey	Frey Industries, Inc.
ft/day	Feet per Day
Gloss Tex	Gloss Tex Industries, Inc.
GPM	Gallon per Minute
GRA	General Response Action
GWQS	Groundwater Quality Standard
HABA	HABA International, Inc.
HI	Hazard Index
Honeywell	Honeywell International, Inc.
HQ	Hazard Quotient
ICT	Identification of Candidate Technologies
IDA	Industrial Development Associates/Corporation
IEUBK	Integrated Exposure Uptake Biokinetic Model
IGWSSL	Impact to Groundwater Soil Screening Level
ISRA	Industrial Site Recovery Act
LDR	Land Disposal Restriction
LNAPL	Light Non-Aqueous Phase Liquid
LSRP	Licensed Site Remediation Professional
MCL	Maximum Contaminant Level
MEK	Methyl Ethyl Ketone
MIBK	methyl isobutyl ketone
mg/kg	Milligram per Kilogram
mg/L	Milligram per Liter
MNA	Monitored Natural Attenuation
MSL	Mean Sea Level
MTBE	Methyl Tert-Butyl Ether
NAPL	Non-Aqueous Phase Liquid
NCP	National Contingency Plan
NFA	No Further Action
ng/kg	Nanograms per Kilogram
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NRDCSRS	Non-Residential Direct Contact Soil Remediation Standard
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit

Acronym	Definition
PAH	Polycyclic Aromatic Hydrocarbons
PAL	Project Action Limit
PAR	Preliminary Assessment Report
PbB	Blood Lead
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethylene
PHC	Petroleum Hydrocarbon
PI	Primary Identification
PMK	PMK Group, Inc.
POTW	Publicly Owned Treatment Works
PPG	PPG Industries, Inc.
ppm	Parts per Million
PRG	Preliminary Remediation Goal
PVSC	Passaic Valley Sewerage Commission
Ramboll	Ramboll US Corporation
RAO	Remedial Action Objective
RAP	Remedial Action Permit
RAWP	Remedial Action Work Plan
RBC	Risk Based Concentrations
RCRA	Resource Conservation and Recovery Act
RfC	Reference Concentration
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RIP	Riverside Industrial Park
RIR	Remedial Investigation Report
RME	Reasonable Maximum Exposure
ROD	Record of Decision
Roloc	Roloc Film Processing
RPD	Relative Percent Difference
RSL	Regional Screening Levels
Samax	Samax Enterprises
SCSR	Site Characterization Summary Report
SF	Square Foot
Site	Riverside Industrial Park Superfund Site
SLERA	Screening Level Ecological Risk Assessment
SRP	Site Remediation Program
SRS	Soil Remediation Standards
SSDS	Subsurface Depressurization System
SVE	Soil Vapor Extraction

Acronym	Definition
SVOC	Semivolatile Organic Compound
SY	Square Yard
TBC	To Be Considered
TCDD	2,3,7,8-Tetrachlorodibenzo-*para*-dioxin
TCA	Trichloroethane
TCE	Trichloroethene
TCLP	Toxicity Characteristics Leaching Procedure
Tetra Tech	Tetra Tech Inc.
TEX	Toluene, Ethylbenzene, Xylene
TIC	Tentatively Identified Compound
TMV	Toxicity, Mobility, or Volume
TPH	Total Petroleum Hydrocarbon
TSCA	Toxic Substances Control Act
TSD	Treatment, Storage or Disposal
TWP	Temporary Well Point
µg/dL	Microgram per Deciliter
µg/kg	Microgram per kilogram
µg/L	Microgram per Liter
µg/m^3	Microgram per Cubic Meter
UHC	Underlying Hazardous Constituent
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank
UTS	Universal Treatment Standard
VISL	Vapor Intrusion Screening Level
VIT	Vapor Intrusion Technical Guidance
VOC	Volatile Organic Compound
Woodard & Curran	Woodard & Curran, Inc.
WRA	Well Restriction Area

EXECUTIVE SUMMARY

This report presents the results of the Feasibility Study (FS) conducted at the Riverside Industrial Park Superfund Site (the Site) located in Newark, Essex County, New Jersey. The FS was conducted in accordance with the Administrative Settlement Agreement and Order on Consent (ACO) and prepared on behalf of PPG Industries (PPG). The FS is subject to approval by U.S. Environmental Protection Agency (USEPA).

The original paint manufacturing facility was constructed in the early 1900s by the Patton Paint Company. As stated in the Site Characterization Summary Report (SCSR; Woodard & Curran, 2015), metal pigments were brought to the Site for the manufacturing of paints, including basic lead carbonate (also known as white lead) and copper oxide. Patton merged into the Pittsburgh Plate Glass Company in 1920. After discontinuing all manufacturing operations in 1971, the property has been subdivided into the 15 separate lots that exist today with multiple former owners and various industrial-related tenants. A USEPA-approved remedial investigation (RI) was initiated at the Site in August 2017 and supplemental RI activities were conducted in December 2018. Based on the findings of the RI, media of concern include waste, soil/fill, groundwater, soil gas, and sewer water. Remedial action objectives (RAOs) were developed for these media to mitigate potential site-related health risks, and corresponding General Response Actions (GRAs) were identified that could potentially satisfy the RAOs.

Several contaminants were identified as Chemicals of Potential Concern (COPCs) in the Baseline Health Human Health Risk Assessment (BHHRA) (Ramboll US Corporation [Ramboll], 2020a) and Chemicals of Potential Ecological Concern (COPECS) in the Screening Level Ecological Risk Assessment (SLERA) (Ramboll, 2020b). Copper and lead are the soil/fill COPCs. Naphthalene, TCE, and total xylenes are soil/fill COPCs with unacceptable risks/hazards associated with soil gas. The BHHRA identified several volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals as COPCs in groundwater in a hypothetical potable use scenario. Additional COPCs were identified by comparing the soil/fill RI and groundwater RI data to Applicable or Relevant and Appropriate Requirements (ARARs).

Preliminary remediation goals (PRGs) are chemical-specific, quantitative goals for each medium and/or exposure route that are intended to meet the RAOs and to be protective of human health and the environment from the COPCs and COPEC. Risk-based PRGs were developed for soil/fill for lead and copper, and risk-based PRGs were developed for soil/fill for naphthalene, TCE, and total xylenes that would be protective from vapor intrusion (soil gas). For the remaining ARAR exceedances in soil/fill and groundwater, the PRGs was set equal to the ARAR value.

Initial alternatives were developed for wastes, soil/fill, groundwater, sewer water, and soil gas. A preliminary screening evaluation of assembled alternatives was performed, including a general evaluation of effectiveness, implementability and cost for each initial alternative. The alternatives remaining after preliminary screening for detail analyses are listed below:

Waste	Alternative 1 – No Action
	Alternative 2 – Removal and Off-Site Disposal
Soil/Fill	Alternative 1 – No Action
	Alternative 2 – Institutional Controls and NAPL Removal
	Alternative 3 – Institutional Controls, Engineering Controls, and NAPL Removal
	Alternative 4 – Institutional Controls, Engineering Controls, Focused Removal with Off-Site Disposal of Lead, and NAPL Removal

	Alternative 5 - Institutional Controls, In-Situ Remediation, Engineering Controls, and NAPL Removal
Groundwater	Alternative 1 – No Action
	Alternative 2 – Institutional Controls, Site Containment at River Edge, and Pump and Treat
	Alternative 3 – Institutional Controls and In-Situ Remediation
	Alternative 4 – Institutional Controls, Pump and Treat, and Targeted Periodic In-Situ Remediation
Sewer	Alternative 1 – No Action
	Alternative 2 – Removal and Off-Site Disposal
Soil Gas	Alternative 1 – No Action
	Alternative 2 – Institutional Controls, Air Monitoring or Engineering Controls (existing occupied buildings) and Site-Wide Engineering Controls (future buildings)
	Alternative 3 – Institutional Controls, Site-Wide Engineering Controls (future buildings), and Air Monitoring or Engineering Controls and In-Situ Remediation of Soil/Fill (existing occupied buildings)

A comparative analysis section was then completed to evaluate how each of the remedial alternatives achieves the evaluation criteria relative to one another. Alternatives were evaluated using USEPA NCP threshold criteria (overall protectiveness and compliance to ARARs) and balancing criteria (long-term and short-term effectiveness, implementability, reduction in toxicity, volume, or mobility, and cost). Overlapping components of alternatives from different media may also present cost benefits, increase the effectiveness of a treatment, and reduce the duration of treatment.

Waste: Waste Alternative 2 (removal and off-site disposal) rates better than Waste Alternative 1 (No Action) in terms of overall protectiveness and compliance with ARAR, which are threshold evaluation criteria. Waste Alternative 2 also rates better in terms of the balancing evaluation criteria for long-term effectiveness and reduction of TMV since action would be taken under Waste Alternative 2 to remove and dispose waste and principal threat waste on Lot 64. In terms of short-term effectiveness, implementability, and cost, Waste Alternative 1 rates better as no action is taken. Waste Alternative 2 would need to be combined with a soil/fill alternative that addresses the NAPL-impacted soil/fill not associated with the USTs on Lot 63.

Soil/Fill: Soil/Fill Alternative 3 (Institutional Controls, Engineering Controls, and NAPL Removal), Soil/Fill Alternative 4 (Institutional Controls, Engineering Controls, Focused Lead Removal, and NAPL Removal), and Soil/Fill Alternative 5 (Institutional Controls, Engineering Controls, In-Situ Remediation, and NAPL Removal) rate better than Soil/Fill Alternative 1 (No Action) and Soil/Fill Alternative 2 (Institutional Controls and NAPL Removal) in terms of overall protectiveness and compliance with ARAR, which are threshold evaluation criteria. Soil/Fill Alternative 1 and Soil/Fill Alternative 2 would not meet the chemical-specific ARARs and would not be protective since no engineering controls or active remediation to prevent human health or ecological exposure to residual contamination (other than removal of NAPL-impact soil on Lot 63 in Alternative 2). While Soil/Fill Alternative 3 would comply with chemical-specific ARARs through capping of soil/fill, Soil/Fill Alternative 4 would offer better compliance with the chemical-specific ARARs since lead-contaminated soil/fill around Building #7 would be removed from the Site. Stabilization/solidification methods (Soil/Fill Alternative 5) would meet chemical-specific ARARs for all contaminants, depending on the efficacy of the treatment. Location- and action-specific ARARs are met by Soil/Fill Alternatives 3 through 5. Soil/Fill Alternatives 3 through 5 rate the best for preventing off-site transport of soil/fill containing COCs by construction of a bulkhead. None of the Alternatives eliminate the need for institutional controls.

In terms of the balancing evaluation criteria for long-term effectiveness and reduction of TMV, Soil/Fill Alternative 4 rates better than the other alternatives. Soil/Fill Alternative 4 provides the best permanence due to excavation/disposal of lead-contaminated soil/fill around Building #7. In terms of TMV, Soil/Fill Alternative 4 rates the best for reducing volume and toxicity of COC on-site with the removal and off-site disposal of elevated lead around Building #7, which will also remove co-located contaminants in the excavation.

Not including the No Action alternative, Soil/Fill Alternative 2 rates best in terms of the balancing criteria for short-term effectiveness, implementability, and cost while Soil/Fill Alternative 5 rates the worst due to challenges associated with implementing the in-situ technology around the buildings and bulkhead and the greatest impacts and disruption to active business on Site. The northern portion of the Site is extremely congested with ongoing business activities and also provides the only vehicle access point. Soil/Fill Alternative 5 treatment areas in the northern portion will cause significant disturbances to businesses, as reagent delivery to the subsurface will require the use of either large diameter augers, which may not be feasible due to underground utilities, and closely spaced injection points, due to the relatively shallow depth of impacts. Soil/Fill Alternatives 2 through 5 have similar long-term O&M obligations through institutional controls.

Other than the No Action alternative, none of the soil/fill alternatives reduce these obligations to less than 30 years assumed in the FS process.

Groundwater: All of the groundwater alternatives will be impacted by the on-going dissolution of residual COC in the soil/fill to the groundwater. Other alternatives, including waste removal, capping, or excavation of contaminated soil/fill, may reduce residual COC infiltration into groundwater from unsaturated soil/fill.

Groundwater Alternative 4 (pump and treat with targeted periodic in-situ remediation) rates the best in terms of the threshold evaluation criteria (overall protectiveness and compliance with ARARs) and the balancing evaluation criteria of long-term effectiveness, with Groundwater Alternative 2 (contaminant at river edge and pump and treat) and Groundwater Alternative 3 (In-Situ Remediation) rating slightly lower in these criteria largely due to their sole reliance on either pump and treat or in-situ applications as singular components, which will likely extend the timeframe to achieve the goal of groundwater restoration. Groundwater Alternative 1 (No Action) would not meet the chemical-specific ARARs since no action would be taken. Location- and action-specific ARARs are met by Groundwater Alternatives 2 through 4. While Alternatives 3 and 4 (in-situ) may face performance challenges associated with aquifer chemistry, Groundwater Alternative 4 benefits from the hydraulic control and ex-situ treatment from the pump and treat system.

Not including the No Action alternative, Groundwater Alternative 4 ranks highest for implementability, while Groundwater Alternative 2 is rated lower because of the construction of the barrier wall, and Groundwater Alternative 3 is affected by the multiple targeted rounds of in-situ injection. The implementability of Groundwater Alternatives 2 and 4 are also affected by the need to designate a portion of the property for construction of a new treatment facility. While handling of treatment reagents lowers the short-term effectiveness rating for Groundwater Alternatives 3 and 4, the in-situ technology potentially destroys VOC contaminant mass, resulting in better rating for these two alternatives. It should be noted that Groundwater Alternative 4 has targeted periodic injections, which will be less disruptive than Groundwater Alternative 3 with its multiple large-scale injections.

In terms of cost, Groundwater Alternative 3 and Groundwater Alternative 4 are similar with construction of the containment wall affecting the cost on Groundwater Alternative 2. Not including the No Action alternative, all of the groundwater alternatives include a long-term O&M through institutional controls and long-term groundwater monitoring, whereas Groundwater Alternatives 2 and 4 have substantial long-term costs associated with O&M of pump and treat systems. None of these five groundwater alternatives eliminate O&M obligations to less than 30 years assumed in the FS process, although it is possible that the source removal activities included in the waste and soil/fill alternatives may reduce certain O&M obligations over time.

Regarding USEPA's guidance on the use of Green and Sustainable Remediation in the CERCLA site remediation process, Groundwater Alternative 4 rates the lowest for environmental sustainability because of the potential risk that additional resources could be expended to treat river water, which is not site-related media. However, proper system controls and hydraulic management can be used to mitigate this risk.

Sewer: Sewer Alternative 2 (removal and off-site disposal) rates better than Sewer Alternative 1 (No Action) in terms of overall protectiveness and compliance with ARAR, which are threshold evaluation criteria. Sewer Alternative 2 also rates better in terms of the balancing evaluation criteria for long-term effectiveness and reduction of TMV since action would be taken under Sewer Alternative 2 to remove and dispose waste sewer material. In terms of short-term effectiveness, implementability, and cost, Sewer Alternative 1 rates better as no action is taken.

Soil Gas: Soil Gas Alternative 2 (Institutional Controls, Site-Wide Engineering Controls, and Monitoring/Engineering Controls) and Soil Gas Alternative 3 (Institutional Controls, Site-Wide Engineering Controls, and In-Situ Remediation) rate better than Soil Gas Alternative 1 (No Action) in terms of overall protectiveness and compliance with ARAR, which are threshold evaluation criteria. For Soil Gas Alternative 2 and Soil Gas Alternative 3, potential risks/hazards associated with soil gas are directly addressed through air monitoring and engineering controls for both existing occupied buildings and future buildings.

In terms of the balancing evaluation criteria, Soil Gas Alternative 3 rates better than Soil Gas Alternative 2 for long-term effectiveness and reduction in TMV, as this alternative would include provisions to directly address soil/fill associated with potential vapor intrusion risks/hazards at occupied buildings and the selected in-situ technology would destroy contaminant mass. However, Soil Gas Alternative 2 rates best in terms of short-term effectiveness and implementability. Soil Gas Alternative 3 is considerably higher in cost compared to Soil Gas Alternative 2; the additional cost (for implementing in-situ remediation in lieu of air monitoring or engineering controls) is not commensurate with the expected benefit to the threshold evaluation criteria of overall protectiveness and compliance with ARARs.

1. INTRODUCTION

This Feasibility Study Report (FS Report) describes the performance of the feasibility study (FS) at the Riverside Industrial Park Superfund Site (the Site) located in Newark, Essex County, New Jersey on Riverside Avenue (Figure 1-1). The FS was conducted in accordance with the Administrative Settlement Agreement and Order on Consent (ACO) (Comprehensive Environmental Response, Compensation, and Liability Act of 1980 [CERCLA] Docket No. 02-2014-2011) as directed by U.S. Environmental Protection Agency (USEPA). The FS conducted under this Settlement Agreement is subject to approval by USEPA.

The FS was prepared in accordance with USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final, October 1988 (Office of Solid Waste and Emergency Response [OSWER] Directive Number 9355.3-01) (hereafter referred to as the Remedial Investigation/Feasibility Study [RI/FS] Guidance). The FS contains remedial alternatives that have been evaluated by USEPA as a basis for determining an appropriate course of action for the Site in order to protect human health and the environment.

The Remedial Investigation Report (RIR) (Woodard & Curran, Inc. [Woodard & Curran], 2020) along with the two risk assessments provide data collected in the remedial investigation (RI) for the development of remedial alternatives in the FS. The FS Report represents the third and final deliverable in the FS process and builds upon the two previous FS deliverables for the Site.

The initial FS deliverable is the Identification of Candidate Technologies (ICT) Memorandum (Woodard & Curran, 2019a). This ICT Memorandum constitutes Task 5 of the Statement of Work contained in the ACO. The ICT Memorandum is an initial analysis of potential candidate remedial technologies that were considered later in the FS process as potential components of remedial alternatives for the Site. It includes an initial evaluation of available information on the performance, relative costs, applicability, effectiveness, and implementability of the candidate technologies.

The ICT Memorandum was prepared prior to the completion of RI data collection and preparation of the Baseline Human Health Risk Assessment (BHHRA) (Ramboll US Corporation [Ramboll], 2020a) and Screening Level Ecological Risk Assessment (SLERA) (Ramboll, 2020b). The ICT Memorandum was submitted in September 2018 shortly after RI Phase 1 was completed. Information on site conditions gathered during Phase 1 provided the basis for the ICT Memorandum. The ICT Memorandum was revised based upon USEPA comments (October 31, 2018 and April 3, 2019) and discussions between PPG Industries (PPG) and USEPA. The June 12, 2019 ICT Memorandum was approved by USEPA on July 17, 2019.

The Development and Screening of Remedial Alternatives Technical (DASRAT) Memorandum (Woodard & Curran, 2019b), the second FS deliverable, was also prepared and submitted to USEPA prior to the completion of the RI, including the risk assessments. The DASRAT Memorandum further refined the candidate technologies from the ICT Memorandum using site characterization information and USEPA's comments on the ICT Memorandum. The DASRAT Memorandum was submitted to USEPA on August 28, 2019. USEPA provided comments in November and December 2019 on the DASRAT Memorandum and responses were submitted to USEPA. USEPA conditionally approved the August 2019 DASRAT Memorandum on February 27, 2020 with the condition that USEPA comments be incorporated into the FS. The FS Report builds upon the information presented in the DASRAT Memorandum, incorporates updates based on additional information and changes in site conditions since the preparation of the DASRAT Memorandum, and presents a focused evaluation and comparative analysis of remedial alternatives.

1.1 Purpose of Report

This FS Report develops and examines remedial action alternatives and presents a remediation strategy to address risk and hazards that exceed applicable risk management criteria or standards and are attributable to site-related constituents in environmental media at the Site. Remedial action alternative development and screening considered:

- Site characterization results, including the findings of the human health and ecological risk assessments, as presented in the RIR (Woodard & Curran, 2020);
- Federal and State regulations that are applicable or relevant and appropriate requirements (ARARs);
- Preliminary remediation goals (PRGs)/remedial action objectives (RAOs); and
- Nature and extent of impact at the Site.

This FS Report further evaluates, refines, and analyzes the remedial alternatives presented in the DASRAT Memorandum.

In accordance with USEPA protocols, this FS Report provides information for decision-makers to compare alternatives and to develop a Proposed Plan, which identifies the agency's preferred alternative and the rationale for selecting the preferred alternative. After receiving State and community acceptance on the preferred alternative, USEPA will issue a Record of Decision (ROD), setting forth the selected remedy, and a Responsiveness Summary, addressing comments received on the preferred alternatives.

1.2 Organization

The remainder of the FS Report is organized as follows:

- Section 2, Background, provides an overview of the physical and ecological setting of the Site, chronicles the Site's ownership and operational history, and summarizes the results of activities conducted in support of the RI/FS.
- Section 3, Objectives and Requirements of Site Remediation, provides an overview of remediation requirements based on RI results, and related site-specific PRGs/RAOs, ARARs, and General Response Actions (GRAs); and identifies areas and volumes to be remediated.
- Section 4, Identification and Screening of Technologies and Process Options, identifies and screens process options based on effectiveness, implementability, and relative cost; and provides a general description of selected process options considered for remedial action alternative development.
- Section 5, Development and Screening of Alternatives, presents remedial action alternatives that have been developed and screened from the retained process options.
- Section 6, Detailed Analysis of Alternatives, presents an analysis and comparison of remedial action alternatives identified and retained in Section 5 based on seven evaluation criteria. The remaining two criteria, State acceptance and community acceptance, will be evaluated in the ROD.
- Section 7, References, provides references used in the preparation of this FS Report.

Tables, figures, appendices, and attachments support the text and are referenced where appropriate.

2. BACKGROUND

The following information is from the RIR (Woodard & Curran, 2020) and provides a Site description, an overview of the Site history, and a summary of previous environmental investigations and removals performed at the Site on behalf of responsible parties through the New Jersey Department of Environmental Protection (NJDEP) Site Remediation Program (SRP) or via independent actions performed by USEPA. The results of the 2017-2019 USEPA CERCLA RI are also summarized in this section.

2.1 Site Description

The Site is a 7.6-acre active industrial site, previously owned by Patton Paint Company until 1971, and located in Newark, Essex County, New Jersey (Figure 1-1). After 1971, the Site was subdivided into 15 parcels/lots, and is identified as the Riverside Industrial Park (RIP). The lots in the northern portion of the Site have Riverside Avenue addresses (Lots 1, 57, 58, 59, 60, 69, and 70), while the lots in the southern portion of the Site have McCarter Highway addresses (Lots 61, 62, 63, 64, 65, 66, 67, and 68). Both Riverside Avenue and McCarter Highway border the Site to the west along with a segment of railroad track adjacent to McCarter Highway (Figure 2-1). Vehicle access is from Riverside Avenue. Much of the surface area of the Site is covered by buildings or pavement. The Passaic River and its tidal mudflat border the Site on the east side. A steel, concrete, or wooden bulkhead provides a retaining wall along most of the Site adjacent to the Passaic River; however, the bulkhead has fallen into disrepair in some locations and is collapsed in several sections. Recent site observations indicate a combined sewer outfall pipe under the area of Lot 63 has collapsed, causing subsidence and a collapse of a section of the bulkhead.

There are 14 buildings at the Site with five of the buildings being vacant (Buildings #6, #7, #12, #15, and #17). At the time of the FS, Buildings #1, #2, #3, #9, #10, #13, #14, and #16 had ongoing business operations, and a small garage building (Building #19) was used for storage by the occupant of Building #13. Portions of Lot 64 and former Building #4 had vehicle dismantling activities during some of the FS activities. Surface waste piles on the south portion of the Site and asbestos-containing materials within Building #7 were removed by USEPA during the RI but are not part of the FS.

2.2 Site History

An 1873 map from Atlas of the City of Newark indicates that most of the Site was reclaimed from the Passaic River with imported fill. An 1892 Certified Sanborn Map suggests that some filling occurred in the late 1800s; however, the major filling events at the Site occurred from 1892 to 1909. The origin of fill material at the Site is unknown. Boating docks shown on the north and central portions of the Site in 1892 suggest some placement of fill and reclamation of land from the Passaic River occurred. Most of Lots 57, 61, 62, 63, 64, 66, 67, 68, and 70 were within the footprint of the Passaic River with the Triton Boat Club operating a dock area on the north side of Lot 60. By 1909, most of the lots had been created via filling and land development and included Patton Paint Company structures, a hotel, and a boat club. Portions of Lots 57 and 70 remained part of the Passaic River in 1909 but were created by placement of fill prior to 1931.

From approximately 1902 to 1971, the Site was used for paint, vanish, linseed oil and resin manufacturing by the Patton Paint Company. Patton Paint Company merged into the Paint and Varnish Division of Pittsburgh Plate Glass Company in 1920, which changed its name to PPG Industries, Inc. (PPG) in April 1968. After discontinuing all manufacturing operations, PPG conveyed its interest in the Site in August 1971. Since then, the property has been subdivided into the 15 separate lots that exist today with multiple former owners and various industrial-related tenants. Detailed descriptions of the Site's ownership history, operational history, historical activities, documented releases, and previous site investigations are provided in RIR Sections 1.3 and 1.4. Highlights from those descriptions are provided below.

- PPG housed paint and varnish manufacturing operations from approximately 1902 to 1971. PPG's operations involved current Lot 1 and Lots 57 through 70. As stated in the SCSR (Woodard & Curran, 2015), metal pigments were brought to the Site for the manufacturing of paints, including basic lead carbonate (also known as white lead) and copper oxide.

- Frey Industries, Inc. (Frey) occupied Lots 1, 61, 62, 63, and 64 from 1981 to 2007 when operations ceased. Frey warehoused, packaged, repackaged, and distributed client-owned chemicals. As stated in the SCSR, products handled by Frey included polyester resins, flammable liquids, corrosives, and poisons. Jobar operated on a portion of Frey's leased property between 1979 and 1982 before its assets were acquired by Frey in 1983. Hazardous wastes generated during the Jobar and Frey operations were a result of cleaning transfer lines, floor sweepings, and absorbents used for cleanup of spills.
- Baron Blakeslee, Inc. (BBI) was a sub-tenant of Frey since the early 1980s. BBI occupied Lot 61 for product distribution, warehousing a variety of chemical products, and analysis of various chemical blends and waste samples. They also reportedly used Building #7 (Lot 63) as a laboratory, Lot 62 for drum storage, and Lot 68 as a common truck and tanker parking area where a 25-gallon tetrachloroethene spill occurred in 1987. Purex (BBI's parent company) was acquired by Allied Signal. After a series of mergers and acquisitions, BBI became part of Honeywell International, Inc. (Honeywell) in 1999. The City of Newark currently owns Lots 58, 61, 63, 64, and 68.
- Universal International Industries was identified as conducting various manufacturing operations on Lots 1, 63, and 64. No specific information was located regarding its manufacturing activities.
- Samax Enterprises (Samax) occupied Lot 1 from 1999 to 2011 when operations ceased. Samax stored various raw materials on-site and manufactured various chemicals under the brand name Rock Miracle. As stated in the SCSR, other products include deck strippers, deck wash, marine paint removers, restoration cleaners, lead paint removers, masonry cleaners, paint hardeners, and various solvents. An industrial company 29 Riverside, LLC currently occupies Lot 1. (The property is currently owned by Hatzlucha on Riverside, LLC.)
- HABA International, Inc. (HABA) occupied Lot 57 from at least 1982 until 1988. Davion Inc. (Davion), successor to HABA, currently operates on Lot 57. (The property is owned by Plagro Realty, Inc.) HABA and Davion manufactured nail polish remover and related products. As stated in the SCSR, products included acetone, ethyl acetate, dyes, fragrances, fatty acids, and lubricating oil. A material identified as HC Blue 2 was released in 1993 as a result of a fire involving nitrated aniline. Acupak, Inc. was a sub-tenant of HABA on Lot 57 from at least 1987 to 1988 and conducted packaging for HABA.
- Roloc Film Processing (Roloc) occupied Lot 60 from 1985 until 2008 when operations ceased, and manufactured foils utilized for holograms and decoration in plastic, graphic, automobile, and other related industries. As stated in the SCSR, the coatings on the foils were made from solvent-based material, such as butyl acetate, naptha, ethyl alcohol, methyl isobutyl ketone, and cellosolve aceate.
- Gilbert Tire Corporation has occupied Lot 60 since at least 2015 (following Roloc's occupation) and is the current occupant. (The property is owned by Shefah in Newark, LLC.) There is no manufacturing equipment. Used tires and wheel rims are stored until transferred off property.
- Chemical Compounds, Inc. (CCI) is the listed owner of Celcor Associates, LLC and has occupied Lots 62, 66, and 67 from at least the early 1990s and are the current owners. These companies manufactured hair dyes and other personal hygiene products using the following raw materials: 8-hydroxyquinoline (technical, pure, sulfate, citrate, and benzoate), copper-8-quinolinolate, ammonium adipate/benzoate, diphenylacetonitrile, and 2-nitro-p-phenylene diamine (as stated in the SCSR). Beginning in 2015, Teluca began operating on Lot 62. Teluca packages and distributes hair dyes, hair color, and related ingredients to hair color marketers. The facility includes a laboratory for completing hair dye research, offices, and warehousing.

- Gloss Tex Industries, Inc. (Gloss Tex) occupied Lot 69 from 1979 to at least 1989 when operations ceased. Gloss Tex manufactured bulk nail enamel, lacquer, and related cosmetic products. According to the SCSR, isopropyl alcohol and dibutyl phthalate are stored on-site. Gloss Tex leased the property from Industrial Development Associates/Corporation (IDA), who currently owns Lot 65.
- Ardmore, Inc. has occupied Lots 59 and 69 (following Gloss Tex's occupation) since 1982 and is the current occupant. (The properties are owned by Sharpmore Holdings, Inc. and Albert Sharphouse.) Ardmore, Inc. manufactures soaps and detergents on Lot 59 and stores empty drums on Lot 69. According to the SCSR, a 1-gallon allyl chloride spill occurred in 1987.
- Monaco RR Construction Company stored railroad rails, cross ties, and spikes on Lot 70. Following their operation, Federal Refining Company (Federal) occupied Lot 70 from 1985 to 2007 when operations ceased. Federal was a scrap metal recycler, specializing in recovery of precious metals for arsenic, barium, cadmium, lead, and zinc. According to the SCSR, an unknown quantity of nitrocellulose spilled in 1990. The current tenant is Midwest Construction Company. Material and equipment used by the company are stored and maintained at the property. (The property is owned by the Estate of Carole Graifman.)

Since 1971, at least 11 documented spills and releases have occurred at the Site, and the Site is subject to at least seven New Jersey Industrial Site Recovery Act (ISRA) remediation cases under NJDEP environmental regulations. Prior to 1971, a vapor cloud released in 1969 from one of the resin reactors in the former PPG Resin Plant (Building #17) ignited, causing a fire/explosion. No discharges to the sewer system or the Passaic River are known to have occurred during this incident. Resin material burned and several process tanks failed during the fire, thus releasing their contents, as discussed in RIR Section 7.2.

Numerous environmental investigations and NJDEP-led remedial actions have been completed on the Site prior to initiating the USEPA CERCLA RI in 2017. The previous areas of concern (AOCs) identified on individual lots were described in the April 2015 SCSR (Woodard & Curran, 2015). The previous AOCs were investigated during implementation of the NJDEP-led RIs. References to "exceedances" in this section pertain to the specific standards and criteria available at the time of previous investigations and remedial actions which may not be equal to the Project Action Limits (PALs) evaluated for the USEPA CERCLA RI or ARARs cited herein.

2.3 Previous Investigations

As summarized in the SCSR and RIR, numerous environmental investigations and NJDEP-led remedial actions have been completed on the Site prior to initiating the USEPA CERCLA RI in 2017. Applicable results were considered in the FS in evaluating remedial action areas. The sections below provide a summary of previous investigations.

2.3.1 Lot 1

Lot 1 (1.229 acres) contains current Buildings #2 and #3 (Figure 2-1) and former Building #4. Building #4 and a portion of Building #3 were demolished in 1982 after a fire. Buildings #2 and #3 are interconnected and have a common basement.

Lot 1 is a New Jersey known contaminated site associated with Acupak Inc. (ISRA Case #88484) and Samax (ISRA Case #E20110199). The Samax case is still active as ISRA Case #E20110199, the only remedial action proposed was for historic fill and included the implementation of engineering and institutional controls to address soil/fill contamination and a historic fill classification exception area (CEA) for groundwater. The historic fill CEA indicates arsenic, iron, lead, manganese, and sodium concentrations above the NJDEP Groundwater Quality Standard (GWQS) are a result of historical fill. Samax is awaiting direction from USEPA on implementation of the remedial actions under New Jersey PI #563216.

Based upon November 2019 observations, the property has tenants with ongoing commercial activities. Refer to RIR Section 1.4.1 for details and previous investigations.

2.3.2 Lot 57

Building #10 is on Lot 57, which is 0.42 acre (Figure 2-1). The entire surface is paved or under a building. Based upon November 2019 observations, the property has ongoing industrial activities.

An acetone spill occurred in 1988 which resulted in acetone-impacted soil/fill being removed from Lot 57 by HABA. Although the post-excavation soil/fill results reportedly indicated that no volatile organic compound (VOC) contamination existed, tabulated results or laboratory reports had not been located in NJDEP files.

2.3.3 Lot 58

Buildings #15 and #15A are located on this Newark-owned property which has an area of 0.2523 acre (Figure 2-1). Former Building #23 was removed between 1979 and 1987. Based upon November 2019 observations, the property is vacant.

As described in the SCSR and RIR, AOCs pertaining to environmental conditions were identified at Lot 58 in 2009 by Newark's consultant (PMK Group, Inc. [PMK]/Birdsall Services Group [Birdsall], 2009a and 2009b).

Following NJDEP regulations, six AOCs were investigated via a surficial geophysical survey, soil borings and sampling, and groundwater sample (temporary well point [TWP]) collection from soil borings. Historic (2009) groundwater samples from TWPs indicated concentrations of metals, VOCs, semivolatile organic compounds (SVOCs), and pesticides above the NJDEP GWQS. These soil and groundwater results were considered in the RIR and FS.

The USEPA inspected tanks in Building #15 after precipitation water was removed from the building to determine if hazardous material was present in the building during a Time Critical CERCLA Removal Action. The tanks were determined to be empty. There were also no visible signs of contamination in the 2 inches of water remaining in the building floor, and sample results received later confirmed that observation. USEPA then determined that there were no hazardous materials present and, therefore, Building #15 posed no threat to human health and the environment (USEPA, 2011). Refer to RIR Section 1.4.3 for previous investigation details.

At the completion of RI field activities (February 2019), the interior aboveground storage tanks (ASTs) and one exterior AST are still present. The small security building at the Site entrance has been damaged by fire. Surface debris piles are present on the lot. Portions of the property are used for parking by employees from other lots.

2.3.4 Lot 59

Building #14 is on 0.405 acre on Lot 59 (Figure 2-1). Based upon November 2019 observations, the property has ongoing industrial operations.

No environmental investigations have been identified at the property. As summarized in the RIR and SCSR, several spills have been associated with Lot 59. Documentation of the specific locations of the spills/releases has not been found.

2.3.5 Lot 60

Lot 60 is 0.703 acre and includes Building #1 and, during the RI, had ongoing commercial activities (Figure 2-1).

The property has been subjected to a NJDEP-led remediation. The Site is identified as Roloc/Color Enterprises (PI #467682) with investigation activities occurring in 2009 and 2017. Applicable results from these investigations were considered in the CERCLA RIR and FS.

Following these investigations, First Environment, Inc. (First Environment) (consultant to Responsible Party) determined that no further action (NFA) was required for the soil/fill and a CEA for historic fill impacts to groundwater. The historic fill CEA indicated mercury, arsenic, aluminum, chromium, iron, and lead concentrations were above the NJDEP GWQS. The Responsible Party is awaiting direction from USEPA on implementation of their Remedial Action Work Plan (RAWP) (First Environment, 2017). Refer to RIR Section 1.4.5 for details on previous investigations.

2.3.6 Lot 61

Lot 61 is 0.265 acre and includes Building #6 (Figure 2-1), and during the RI, the property was vacant.

No investigations have specifically addressed potential environmental impacts on this lot. The deed notice filed by the property owner (City of Newark) indicates there is potential for encountering contaminated historic fill beneath Building #6. The concrete building slab is identified as an engineering control. The Responsible Party associated with the deed notice is Honeywell, successor to BBI. The deed notice identifies contaminants associated with the historic fill as being VOCs and metals. The New Jersey PI number is G0000005586. RIR Section 1.4.6 provides details on Lot 61 previous investigations.

2.3.7 Lot 62

Two-story Building #9 is located on Lot 62 (0.492 acre). Based upon November 2019 observations, the building (Figure 2-1) was occupied by a commercial tenant.

In 1998, IDA (property owner) received an NFA determination from NJDEP related to CCI operations. In 2008, an investigation, including the collection and analyses of soil and groundwater samples, was conducted on behalf of CCI (Whitman Companies, Inc. [Whitman], 2012b). The soil samples were considered to be representative of historic fill (Whitman, 2012b). Refer to RIR Section 1.4.7 for previous investigation details.

2.3.8 Lot 63

Lot 63 is 0.541 acre and contains Building #7 and the former Building #7A (Figure 2-1). The City of Newark is the property owner through foreclosure and, based upon November 2019 observations, the property is vacant.

A 2010 Building #7 AST inventory by USEPA indicated 10 empty ASTs on the second floor and 93 ASTs (79 empty) located on the third floor. Beginning in late 2011, USEPA started the process of the solid residue removal from the tanks. The majority of the tanks were empty. The tank contents varied from a “caramel-like” substance to a hardened material that required chipping. Simultaneously, USEPA began the process of removing basement liquid and sludge.

In early 2012, Floor 2 and Floor 3 tank work, along with basement liquid/sludge removal, was stopped due to USEPA budget constraints. In October 2012, Hurricane Sandy caused flooding at the Site. USEPA reported that the basements in Buildings #7 and #15 were flooded after the hurricane. In May 2014, the removal of Building #7 basement liquids and sludges resumed and was completed in August 2014.

The (2009) soil/fill analytical results indicated exceedances of total petroleum hydrocarbon (TPH), VOCs, SVOCs, metals, and polychlorinated biphenyls (PCBs) above NJDEP criteria. The petroleum fingerprint analysis performed on the groundwater sample indicated the presence of mineral spirits and diesel fuel/fuel oil #2 (PMK/Birdsall, 2009b).

Two monitoring wells (ERT-2 and ERT-3) were installed in 2011 on Lot 63. Benzene was the only compound reported above NJDEP GWQS in Lot 63 groundwater (Lockheed Martin, 2011). These monitoring wells were not located or observed during the RI. It is unknown whether the wells were properly decommissioned.

A 2008 deed notice identifies two areas beneath the footprint of Building #7 on the north and east sides as being potentially impacted by historic fill, with the building slab acting as an engineering control. Honeywell is the Responsible Party for maintaining the engineering control. The New Jersey PI number is G0000005586.

In 2017, USEPA initiated an emergency response action to remove debris and biohazard labeled medical waste scattered on the ground (USEPA, 2017). Dumping continued in 2019 on Lot 63. Refer to RIR Section 1.4.8 for previous investigation and remedial action details.

2.3.9 Lot 64

Former Building #5 and Building #12 are on Lot 64 (0.934 acre). The City of Newark is the current property owner through foreclosure (Figure 2-1). Based upon November 2019 observations, the property is vacant.

Building #5 was demolished in 1982 along with Lot 1 Buildings #3 (northern portion) and #4.

Subsequent to a 2009 inventory, USEPA planned to remove the 10 underground storage tanks (USTs). The contents were removed, but due to structural integrity concerns, only two tanks were reportedly removed and soil sampling via test pits was undertaken by Tetra Tech Inc. (Tetra Tech) in 2012. According to the Tetra Tech field report Section 4.0, dark, oil-stained, non-aqueous phase liquid (NAPL) soil/fill material was encountered at all test pit locations, and a black light non-aqueous phase liquid (LNAPL) sheen/film was observed in the pooled groundwater in several test pits. Because of data quality issues, no usable results were generated from the test pit soil samples. No formal UST closure reports have been identified; however, USEPA documentation indicates that two of the 10 USTs were removed by USEPA (USEPA electronic correspondence, January 13, 2012).

The October 2009 "The Passaic River Mystery Oil Spill" (Case #09-10-29-1320-36) was attributed to ASTs in the basement of Building #12. According to USEPA documents, the source of the spill was identified at low tide when a pipe discharging the spill was observed. The pipe was sealed, stopping the release. The pipe that discharged into the

Passaic River was traced to a catch basin. An oily substance in the discharge was observed in the catch basin; a sewer pipe from Building #12 was observed to discharge into the basin. The discharge from the Building #12 sewer pipe resembled the spill material observed in the Passaic River. Section V.16 of the ACO states that USEPA traced the source to two basement tanks in a vacant building located on Lot 64 that had recently been connected to a storm sewer by a hose. Based on its investigation during removal activities, USEPA expressed the opinion that contents of the two basement tanks appeared to have been intentionally discharged into the sewer. The sewer line was plugged and tanks secured by USEPA.

As described in the SCSR, a 2009 Preliminary Assessment Report (PAR) for Lot 64 (Weston, 2009) was completed.

Samples were collected by Birdsall (PMK/Birdsall, 2009b) and USEPA (Tetra Tech, 2010a, 2010b and Lockheed Martin, 2010a, 2010b). As part of the Lot 64 investigation, there was one monitoring well installed (ERT-1/2011) on adjacent Lot 65. Benzene and methylene chloride were the only compounds reported above NJDEP GWQS in Lot 65 groundwater (Lockheed Martin, 2011).

In conjunction with the surface waste removal on Lot 63, Lot 64 surface debris and waste were removed by USEPA in 2017 and 2018. Refer to RIR Section 1.4.10 for details on previous investigations and remedial actions.

2.3.10 Lot 65

Lot 65 is a 0.289-acre vacant lot (Figure 2-1). Based upon historical aerial photographs, PPG records, and Sanborn maps, there were no buildings situated on this lot.

No environmental investigation reports have been found which were completed specifically for this lot; however, in 2006, a groundwater sample was collected from a soil boring on Lot 65 for limited parameters. Lead and 4-chloroaniline were detected above NJDEP GWQS at TB-7 (Whitman, 2012a).

Surface debris piles were present in June 2015 along with a vandalized office trailer. Additional surface debris piles were observed in July 2015 indicating an active dumping area for construction and miscellaneous debris. Surface debris and waste were removed by USEPA in 2017 (USEPA, 2017). The office trailer was removed in 2019.

2.3.11 Lot 66

Lot 66 (0.345 acre) contains vacant Building #17 (Figure 2-1) and former Building #17A. The property is currently (July 2015) in bankruptcy. A small building was located west of Building #17 designated on drawings as Building #17A.

An unknown liquid was released to the Passaic River on January 9, 1992 as a result of illegal dumping. CCI was reportedly pumping the contents of a pit into an open lot (NJDEP Case #92-1-9-1027-18).

A July 1992 release to the Passaic River was reportedly caused by the failure of an industrial sewer line. The release likely occurred in the vicinity of Lot 66. The release was described as a blue/purple dye, wastewater liquid with aniline being a component. The location of the sewer line breach was not found in historical records.

One soil boring (SB-COMP) was advanced in May 2008, and a subsurface soil sample was collected and analyzed from the boring. Total petroleum hydrocarbon (TPH) was detected at 1,400 milligrams per kilogram (mg/kg) and polycyclic aromatic hydrocarbons (PAHs) were not detected (Whitman, 2012a).

A 2010 vapor intrusion investigation of Building #17 was performed because of a tetrachloroethylene (PCE) spill on Lot 68. The conclusions indicated that the results for the Celcor Building/Building #17 did not exceed NJDEP vapor intrusion screening limits.

Three TWPs were installed on Lot 66 and grab groundwater samples were collected in 2006. NJDEP GWQS exceedances of isopropylbenzene, chromium, and lead were identified northwest of Building #17 (upgradient, TB-4 and TB-5). NJDEP GWQS exceedances of carbon disulfide, benzo(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, pyrene, chromium, and lead were identified at TB-6 located downgradient of the wastewater AST. One monitoring well (MW-2) was installed and sampled in 2008 and is identified as RI existing Well E-2.

In July 2015, surface debris and waste piles were present and removed by USEPA in 2017 under an emergency response action (USEPA, 2017). CCI Monitoring Well MW-2 is present on the east side of Building #17 (Lot 66) and was evaluated and sampled during the RI. This well is E-2 in the RI. Refer to RIR Section 1.4.11 for previous investigation details.

2.3.12 Lot 67

Lot 67 is a 0.394-acre vacant lot owned by CCI (Figure 2-1). According to USEPA, the property went through bankruptcy proceedings. A small building with unknown use exists on the eastern side of the lot adjacent to the Passaic River.

According to public records, Lot 67 could be the location of the pit mentioned in allegations of CCI's 1992 illegal dumping on an open lot (NJDEP Case #92-1-9-1027-18).

The southwestern portion of Lot 67 is under a groundwater CEA and deed notice with engineering controls to address groundwater impacts and soil contamination related to historic fill and a Lot 68 PCE spill in 1987 (RIR Figure 1-3). Honeywell is responsible for maintaining the CEA as well as the engineering controls. The New Jersey PI number is G0000005586.

Soil/fill samples were collected in 2008 from Lot 67 with several metals and SVOCs detected above USEPA Regional Screening Levels (RSL) (industrial) or Impact to Groundwater Soil Screening Levels (IGWSSLs) (Whitman, 2012a). Soil data obtained from the three borings indicated that trichloroethene (TCE) (up to 0.13 mg/kg), lead (up to 950 mg/kg), mercury (up to 0.18 mg/kg), and benzo(a)pyrene (0.58 mg/kg) were detected.

In July 2015, surface debris piles along with abandoned equipment were present. USEPA removed these piles in 2017 under an emergency response action (USEPA, 2017). Refer to RIR Section 1.4.12 for previous investigation details.

2.3.13 Lot 68

Lot 68 is a 0.534-acre vacant lot owned by the City of Newark (Figure 2-1). Former Building #20, referred to as a shed, was located along the southern property line of this lot. The majority of the property was covered with asphalt, based upon June 2015 observations. During PPG operations, two naphtha ASTs with 5-foot-high dike containment walls were present along with a 1,400-square foot (SF) drum storage shed (Building #20). The naphtha AST area is currently overgrown and covered by a debris pile. In 2019, vegetation was removed from the former AST area by a City of Newark tenant.

A PCE spill occurred in 1987. Delineation of the spill-related contamination was performed and a cleanup plan developed (Dunn, 1990, 1991, and 1992). Soil/fill was removed from the lot in April 1992. Post-remediation soil sampling was conducted in 1995 (Rust, 1995).

Lot 68 is a New Jersey known contaminated site (NJDEP Case No. 88434). A deed notice with an engineered asphalt/concrete cap is present related to shallow soil impacts of arsenic, lead, PCE, TCE, and zinc. There is also a groundwater CEA covering *cis*-1,2-dichloroethene (DCE), *trans*-1,2-DCE, PCE, TCE, and vinyl chloride. Honeywell is responsible for maintaining the CEA as well as the engineering controls. The New Jersey PI number is G0000005586. Details on Lot 68 previous investigations and remedial activities are in RIR Section 1.4.13.

2.3.14 Lot 69

Building #13 is located on Lot 69. Lot 69 is the northern-most parcel with a size of 0.326 acre (Figure 2-1). The property is currently owned by Sharpmore Holdings, Inc. Old, inactive Ardmore tanks are located to the north and south of the building. The small garage building along the river is currently used for storage (Building #19).

In 1989, three areas of potential environmental concern, including a drum handling area, the loading dock area, and the tractor trailer product transfer area, were identified and excavations were completed, with visually contaminated soil/fill removed. Confirmatory soil samples were collected from the excavations. The Responsible Party's (Gloss Tex) post-remediation soil samples collected from the three excavation areas indicated petroleum hydrocarbon (PHC) and base neutral (BN) concentrations below New Jersey standards at the time (AccuTech Environmental Services, 1989). A negative declaration affidavit was submitted to the NJDEP in November 1989 indicating no additional remedial measures were warranted. Refer to RIR Section 1.4.14 for previous investigation details.

2.3.15 Lot 70

Building #16 (Figure 2-1) is on Lot 70 (0.456 acre). Based upon November 2019 observations, the property has a commercial tenant.

A Responsible Party (Federal) spilled an unknown quantity of nitrocellulose in 1990 and released hydrochloric acid gas in 1993. Federal assessed groundwater quality in 2001. Groundwater contained elevated concentrations of acetone (14,000 to 29,000 milligrams per liter [mg/L]), barium, and lead above the NJDEP GWQS. The occurrence of acetone was attributed to an adjacent property (Lot 57 – HABA acetone release).

Other assessments, investigations, and remedial action at Lot 70 began in 2001. According to the 2008 RAWP (TRC Environmental Corporation, 2008), the NJDEP agreed to list the groundwater CEA contaminants related to historic fill (arsenic, barium, cadmium, lead, and zinc) for Lot 70 and directed Federal to list benzene as a site chemical of concern in the CEA. The CEA for Lot 70 was reportedly established on March 30, 2010 for an indeterminate duration.

In March 2012, soil/fill with PCB concentrations greater than 50 parts per million (ppm) was excavated. A deed notice was recorded on December 4, 2014, restricting the Site to non-residential use only and includes engineering controls. Refer to RIR Section 1.4.15 for details on previous investigations and remedial actions.

2.4 Physical Characteristics of the Site

2.4.1 Surface Features

The majority of the Site (70 percent) is covered with impervious surfaces, such as asphalt (approximately 19 percent), foundation and buildings (approximately 27 percent), and concrete (approximately 24 percent). The remaining portion of the Site is indicated to be pervious (approximately 30 percent) (Figure 2-3).

There are 14 buildings at the Site with five of the buildings being vacant (Buildings #6, #7, #12, #15, and #17). At the time of the RI, Buildings #1, #2, #3, #9, #10, #13, #14, and #16 had ongoing business operations along with a small garage building (Building #19) that was used for storage by the occupant of Building #13. The southern portion of the Site is primarily vacant with four of the five unoccupied buildings located there. Former Building #4 was damaged by fire and was demolished in 1982; a sub-grade concrete slab with concrete walls is currently present that was previously used by post-PPG occupants as secondary containment for multiple ASTs and also for auto-dismantling activities. Former Building #5 was also damaged by fire and demolished in 1982, a vegetated soil/fill mound currently occupies much of the footprint of the building. Debris/soil mounds are also present within a former AST dike on Lot 68 and on the south side of Building #15 on Lot 58. These soil/fill mounds are of unknown origin.

Smaller structures that are present on the Site include a vacant guard-shack at the entrance to the Site along Riverside Avenue and a small concrete structure of unknown use on the eastern side of Lot 67.

Empty ASTs and/or process vessels are present on the exterior of Lots 58, 67, and 69. The empty AST on Lot 58 is a remnant feature from PPG occupation.

At the initiation of the RI, unauthorized surface dumping was prevalent in the southern portion of the Site. Under an emergency removal action, these surficial wastes removed by USEPA in 2017 and 2018 included asbestos-containing materials, household trash, construction debris, bio-hazard waste, and petroleum-impacted materials.

The Passaic River borders the Site on the east side. A steel, concrete, or wooden bulkhead provides a retaining wall along the eastern edge of most of the Site adjacent to the Passaic River. The bulkhead has fallen into disrepair in some locations.

2.4.2 Surface Water Hydrology

An assessment of current topography and resulting surface water patterns at the Site was undertaken in the RI (RIR, Section 3.2). Approximately 15 percent of Site surface drains toward the west (railroad tracks and Riverside Avenue), while approximately 57 percent of the Site drains toward the east. The remaining area (28 percent) is occupied by buildings or hydraulically isolated structures.

The Passaic River has a history of high water events. The topographic survey map of the Site (RIR, Figure 3-2A) has ground surface elevations that range from approximately 6 to nearly 12 feet above mean sea level (AMSL). It appears that 40 to 50 percent of the Site lies at an elevation of 9 feet below mean sea level (MSL) (which is designated by the Federal Emergency Management Agency [FEMA] as the 100-year flood elevation), including Buildings #6, #10, #13, #14, and #16, and portions of Buildings #1, #7, and #9. The top of the river bulkhead is between 6 and 7 feet MSL. This means water levels above 6 feet MSL would cause high water at some portions of the Site, and water levels of 9 feet MSL would represent a 100-year flood at the Site.

2.4.3 Geology and Hydrogeology

The Site consists of large quantities of fill material that were historically placed into the river and adjacent shore to raise the surface elevation to today's approximate elevation, most of which was completed from 1892 to 1909. The majority of the current lots that comprise the Site is located within the footprint of the historical Passaic River. The thickness of fill material ranges in thickness from 6 to 15 feet. The fill material consists predominantly of sands, silts, and gravel, along with man-made materials such as brick, pieces of concrete block, wood, glass, and cinders. The fraction of each material in the fill varies across the Site, however, most of the historic fill material at the Site is characterized as a Loamy Sand or Sand Loam. Based upon historical maps, previous investigations, and data obtained during the RI, fill material is present in surface soil throughout the Site and in subsurface soil where historical filling was conducted to reclaim land from the Passaic River. This material is considered “historic fill” as it complies with the NJDEP definition of historic fill and, therefore, is impacted by chemicals and metals as shown by RI data and NJDEP historic fill designations. Historic fill may also have been impacted due to historical and/or current operations and recent and illegal disposal. Lower portions of the fill are saturated, as evidenced by groundwater depths that are typically less than 6 feet below grade. A silt loam underlies the fill unit over the majority of the Site except in areas to the northwest. The sources of fill are unknown. As fill placement occurred over a more than 30-year period, the sources and thus, physical and chemical properties could be different.

The silt loam is underlain by alluvium deposits. Two groundwater units were investigated: shallow fill and deep. The primary groundwater flow direction in the shallow fill unit and deep unit is to the east toward the Passaic River.

Groundwater elevations are and were typically influenced by tidal changes which are greatest in areas adjacent to the river. The tidal influences were observed in both the shallow fill unit and deep unit. Tidal influence appears to be greater in the northern portion of the Site compared to the southern portion.

RIR Sections 3.3 and 3.4 provide details on Site geology and hydrogeology.

2.4.4 Demography and Land Use

The Site is located within a designated “Dedicated Industrial Zone” allowing commercial and industrial uses and is subdivided into 15 properties. Currently, seven properties are in use and eight properties are vacant. Seven occupied properties (Lots 1, 57, 59, 60, 62, 69, and 70) and three of the vacant properties (Lots 65, 66 and 67) are owned by several entities, and the other five vacant properties (Lots 58, 61, 63, 64, and 68) are owned by the City of Newark. The Site is partially fenced. Based upon observations during the RI, 30 to 40 employees work in the several businesses (warehousing/storage, distribution, or manufacturing) at the Site. There are no residents at the Site.

Surrounding properties include an abandoned petroleum bulk storage facility to the north of Lot 69; an auto body/salvage business to the northwest of Lots 58, 59, and 69 across Riverside Avenue; a construction contracting business to the south of Lots 67 and 68; and a residential neighborhood to the west of McCarter Highway. According to historical maps, the adjoining properties to the north and northwest have been used for fuel oil storage, a retail gas station, and a coal yard.

Based on U.S. Census Bureau data, as of 2017, Newark’s population is diverse, with African American being the largest group followed by Hispanic/Latino, together making up over 75 percent of the population. Median household income is $34,826. Population density is 11,458 per square mile. English is a second language in almost 50 percent of households.

2.4.5 Ecology

The Site is mostly paved or covered by buildings and is partially fenced. Because habitat is restricted, ecological receptors on Site are limited to urban wildlife. Some pervious areas of the Site include opportunistic, low-value ecological habitat that is primarily interspersed between the paved areas and/or buildings and foundations. This habitat is in various stages of growth and/or regrowth due to disturbances from remedial activities. Several types of flora and fauna are present on Site, although most are opportunistic or invasive species. Waterfowl are transient visitors. No raptors or deer have been observed, and no wildlife (other than passerines) was observed during the Site visit. Feral cats are prevalent among the vacant buildings. There are no aquatic resources on Site. However, the Passaic River and a tidal mudflat are adjacent to the eastern edge of the Site. The SLERA contains details on ecological conditions at the Site.

2.5 Nature and Extent of Contamination

This section summarizes the nature and extent of contamination presented in RIR Section 4. In the assessment of nature and extent, sample analytical results were compared to PALs or other screening values such as hazardous waste characteristics. Exceedance of a PAL does not indicate an unacceptable risk to that media. PALs are screening values that can help decision makers target a course of action prior to the risk assessment.

PALs for soil/fill were based on the lowest regulatory/screening criteria of: (1) USEPA RSLs for Resident Soil based on the lower concentrations associated with a cancer risk of 1×10^{-6} (i.e., one in a million) or a non-cancer Hazard Index (HI) = 1, (May 2016), (2) New Jersey Remediation Standards (Residential Soil) 7:26D, or (3) New Jersey Impact to Groundwater Criteria (November 2013).

PALs for groundwater were based on the lowest regulatory criteria of: (1) USEPA RSLs for Tap Water based on the lower concentration association with a cancer risk of 1×10^{-6} or a non-cancer HI = 1 (November 2017), (2) USEPA Maximum Contaminant Levels (MCLs) (November 2017), or (3) NJDEP GWQS (New Jersey Administrative Code [N.J.A.C.] 7:9C – January 18, 2018).

Soil Gas PAL is based on the lowest regulatory criteria of: (1) USEPA Vapor Intrusion Screening Levels (VISL; November 2015) Sub-Slab Soil and Exterior Soil Gas, and (2) NJDEP VISL (March 2013) Soil Gas Screening Levels Residential.

Indoor Air PAL is based on the lowest regulatory criteria of: (1) USEPA VISL (November 2015) Indoor Air concentration (i.e., the lower of the concentrations associated with a cancer risk of 1×10^{-6} or a non-cancer HI of 1, or (2) NJDEP VISL (March 2013) Indoor Air Screening Levels Residential.

2.5.1 Waste

There are a limited number and volume of waste containers and materials (not associated with current operations) observed and sampled in the RI. The limited volume of waste materials is consistent with waste removal actions undertaken by USEPA at the Site. The wastes are not characterized as hazardous wastes based on RI results. Light non-aqueous phase liquid (LNAPL), identified as diesel/heating oil, is present in a UST (Lot 64) and Building #15A (Lot 58).

Six USTs were identified in a tank field north of Building #12 (Figure 2-4). All six USTs contained liquid that was sampled; five tanks did not contain liquids identifiable as a product or waste product, and groundwater and/or surface water infiltration may have occurred. One UST (UST-5) was found to contain LNAPL, identified as a diesel/heating oil, layer approximately 0.9-foot thick. Based on the laboratory waste characterization results, none of the UST liquid was classified as a hazardous waste. The primary VOCs (xylenes and ethylbenzene) reported in nearby groundwater wells (MW-106 and E-3) are the same as the VOCs in the tanks. UST-7 also contained several chlorinated VOCs above 100 micrograms per liter (µg/L). UST-7 still has the same two primary VOCs (xylenes and ethylbenzene) as other USTs but the lack of chlorinated VOCs in the other tanks indicates that these other tanks held different material. Because UST VOC concentrations from five USTs are higher than nearby groundwater, these tank contents remain a potential source of groundwater contamination.

Based on results, Building #15 standing water was not considered a waste. Water was found beneath a steel grated floor in this portion of Building #15A (pump house). A viscose LNAPL layer was identified consistent with diesel/heating oil approximately 0.5-foot to 0.65-foot thick.

2.5.2 Soil/Fill

Surface, subsurface, and vadose zone soils/fill were sampled during the RI. Soil/fill samples collected in 2017 focused on potential AOCs, including loading docks, material handling areas, and raw material storage areas (Figure 2-5). Soil/fill samples collected in December 2018 (Phase 2) were based on the 2017 soil/fill results and included investigation of the saturated zone, along with providing spatial coverage at the Site. Additional details on soil/fill results are provided in RIR Section 4. The RI soil borings were not placed in a grid to support design delineation.

The majority of the Site (except the northwest section) was reclaimed from the Passaic River with imported fill. Fill material is documented at the surface throughout the Site with greater fill thicknesses associated with areas reclaimed from the Passaic River (up to 15 feet thick) and is generally described as a Loamy Sand or Sand Loam in most areas. Permeability testing conducted on two soil samples collected beneath the fill unit representative of the former river bed indicated permeabilities of 1.1×10^{-5} to 3.3×10^{-7} centimeters per second (cm/s). Geotechnical data provided by USEPA indicated that this former riverbed material beneath the fill is more appropriately described as a silt loam. The silt loam layer grades into a fine to coarse-grained sand and gravel with depth, which includes alluvium deposits (Qal) and glacial lake deltaic deposits (Qbn) followed by a silt unit (Qbnl) identified as glacial lake bottom deposits.

Observations of a thick, oil-like substance (NAPL) were noted in the soil/fill at Borings B-34, B-35, and B-90 east and south of the UST area. Monitoring wells in the vicinity of the USTs did not have a measurable thickness of LNAPL; however, a TWP installed at B-34 contained LNAPL. Monitoring wells and TWP did have elevated benzene, toluene, ethyl benzene, and xylenes (BTEX) concentrations, which are potentially indicative of petroleum impacts to groundwater. Isolated areas of NAPL-impacted soil/fill were also observed during the drilling of Monitoring Well MW-201 between the ground surface and 7.2 feet below ground surface (bgs). Monitoring wells in this area of the Site (including Monitoring Well MW-201) did not have a measurable thickness of LNAPL.

Thirty-four VOCs (67 percent) were not detected in soil/fill samples or not reported at concentrations above their PALs. Eight VOCs were identified as soil chemicals of potential concern (COPCs) in the BHHRA. The VOCs that exceeded a PAL most frequently were benzene, methylene chloride, PCE, and TCE. Although toluene, ethylbenzene, and xylene (TEX) (total) were reported at elevated concentrations, most results were below their PALs. The source of BTEX on Lots 63 and 64 is likely the petroleum waste in USTs and soil/fill and recent illegal storage or recent dumping. The highest chlorinated VOC results were from Lot 68 where a PCE release occurred in 1987. BTEX was also reported in that area. The likely sources of these VOCs are illegal dumping and residual contamination from the PCE spill. BTEX and chlorinated VOCs were detected around Building #15. The likely source is recent spills in the area. Elevated acetone concentrations were reported in subsurface soil/fill on Lot 57, but the results were less than 60 percent of the acetone PAL. The source of acetone is likely the acetone storage area associated with current operations on Lot 57.

Fifty-six SVOCs did not exceed PALs. Eight SVOCs were identified as COPCs in the BHHRA. SVOCs above a PAL were widespread, with the majority being on Lots 63, 64, 67, and 68 in surface soil/fill. Benzo(a)pyrene was the SVOC with the most PAL exceedances. Of the SVOCs detected above PALs, benzo(a)pyrene and dibenzo(a,h)anthracene have the lowest PAL at 110 micrograms per kilogram (µg/kg). The sources of the SVOCs above PALs are likely a combination of historic fill, illegal petroleum material spills/storage, petroleum waste in USTs, and historical/current operations.

Twenty-four metals, including mercury, were analyzed in soil/fill samples. In Table 4-2 and Table 4-3 in the RI Report, the highest arsenic, copper, lead, and zinc soil/fill concentrations in the surface and subsurface soils were generally on Lots 63, 64, and 70. As presented in Figure 4-16 of the RI Report, the highest lead concentrations in the surface and subsurface soil/fill (at concentrations greater than 800 mg/kg) were primarily located around the perimeter of Building #7. The majority of zinc concentrations were below PAL on these lots and the other 12 lots. Mercury was detected in the majority of soil/fill samples above its PAL (0.1 mg/kg) with most PAL exceedance on the southern portion of the Site. The source of the metals is likely a combination of historic fill, operations releases, and illegal dumping.

PCB-1254 exceedances were mostly concentrated on the southern portion of the Site in Lots 63, 64, and 65. PCB-1260 exceedances were almost entirely from surface samples collected in the northern portion of the Site and were found on Lots 58, 69, and 70. An NJDEP-led PCB soil/fill excavation occurred on Lot 70.

No pesticides/herbicides, except heptachlor epoxide, were detected in soil/fill samples.

Dioxin/furan results for four of the nine surface soil/fill samples exceeded the PAL for 2,3,7,8-tetrachloro-dibenzo-*para*-dioxin (TCDD); the highest TCDD concentration was detected at location DF-4 at 20.8 nanograms per kilogram (ng/kg). The four (relatively) highest TCDD soil/fill results are on the eastern edge of the Site adjacent to the Passaic River.

2.5.3 Groundwater

The RI characterized the nature and extent of groundwater quality beneath the Site. There are 31 monitoring wells in the shallow fill unit (eight wells were present prior to RI) and five monitoring wells in the deep unit (Figure 2-5). The primary groundwater flow direction in the shallow fill unit and deep unit is to the south-southeast toward the Passaic River.

Evaluation of slug test data for shallow fill unit wells at the Site indicated hydraulic conductivities between approximately 4 and 233 feet per day (ft/day). While the data indicate a range of approximately three orders of magnitude for hydraulic conductivity, the fact that many of the wells are constructed in shallow fill materials suggests this range is reasonable given the heterogeneity of fill. Slug test data for wells in the deep unit indicated higher hydraulic conductivities in the north (average of approximately 210 ft/day) compared to hydraulic conductivities in the south (average of approximately 44 ft/day).

Tidal fluctuations in the deep unit also indicated that deep wells on the north end of the Site also appear to exhibit more tidal influence, suggesting that the subsurface materials on the more northern and inland portions (near MW-205) are more conductive or better connected to the river than areas to the south. Unfiltered groundwater samples were collected and analyzed in March 2018, June 2018, and February 2019. The Phase 1 wells, including the pre-RI wells, have been sampled three times within a year, while the Phase 2 wells were sampled once. Additional groundwater quality information is provided in RIR Section 4.4.

2.5.3.1 Shallow Fill Unit

Over the three sampling events (spanning 11 months), results for the shallow fill unit well samples were relatively consistent. Variations for many of the results may be within reproducibility range of measurement or reflect Site conditions at the time of sampling (seasonal variations, tides, or recent precipitation events). Consequently, no conclusions or data interpretations on changes in shallow groundwater contaminant concentration can be determined.

VOCs: Benzene detections were the most common VOC to exceed the PALs in the shallow fill unit, followed by vinyl chloride, ethylbenzene, 1,1,2-trichloroethane (TCA), 1,1,2,2-tetrachloroethane, and m,p-xylenes. Fourteen VOCs, including benzene, vinyl chloride, ethylbenzene, 1,1,2-TCA and xylenes (total), are groundwater COPCs in the BHHRA. Monitoring Well MW-124 was installed in Phase 2 and sampled once. It has the highest TEX concentrations in the shallow fill unit.

SVOCs: 1,4-Dioxane was the most common SVOC detected (above PALs), followed by naphthalene, benzo(a)anthracene, benzo(a)pyrene, and 1,1'-biphenyl in the shallow fill unit. Twelve SVOCs were identified as COPCs.

Metals: Arsenic, manganese, iron, sodium, cyanide, and lead were detected most often above their respective PALs. Mercury was not detected above its PAL. Eight other metals were detected above their PALs in at least one sampling event. As presented in the RI Report Figure 4-40, elevated concentrations of lead in the shallow fill groundwater were observed in monitoring wells on Lot 63 and 64, and primarily within the vicinity of Building #7. These monitoring wells are located in soil/fill where elevated lead concentrations (greater than 800 mg/kg) were reported in the surface and subsurface as presented in RI Figure 4-16.

PCBs: PCB-1260 was detected in groundwater above its PAL at four shallow fill unit well locations during at least one sampling event (MW-108, MW-118, MW-119, and MW-121). PCB-1254 was detected above its PAL in one sampling event.

NAPLs: Measurable LNAPL was not observed in shallow fill unit monitoring wells; however, a TWP installed at B-34 contained LNAPL. NAPL was observed in soil/fill in the area of Lot 64 USTs (at borings B-34, B-35, and B-90). No dense non-aqueous phase liquid (DNAPL) was observed in the RI monitoring wells. Monitoring wells and TWP did have elevated BTEX concentrations, which are potentially indicative of petroleum impacts to groundwater.

The groundwater areas with the highest concentrations above PALs are as follows:

- Lots 63/64
- Lot 58/Building #15
- Lot 57/Building #10

The first two areas above are contaminated with BTEX and chlorinated solvents. Lot 57 contamination is primarily acetone. Arsenic and lead concentrations above PAL are site-wide with the most exceedances on Lots 63/64. 1,4-dioxane concentrations above PAL were primarily along the river.

2.5.3.2 Deep Unit

The number of parameters above PAL is less in the deep unit groundwater than in the shallow fill unit. Concentrations were also lower in the deep unit.

VOCs: Benzene, 1,1,2,2-tetrachloroethane, and 1,1,2-TCA were the most common VOCs to exceed their PALs in the deep unit groundwater. The methyl tert-butyl ether (MTBE) PAL exceedance is unique to the deep unit as it was not detected in a shallow fill unit well above its PAL. Ten VOCs, including MTBE, were identified as deep unit COPCs in the BHHRA.

SVOCs: In the deep unit groundwater, naphthalene was the most common SVOC detected exceeding its PAL. Three SVOCs were identified as COPCs in the BHHRA.

Metals: Arsenic, manganese, and sodium were detected most often above their respective PALs in deep unit groundwater. Eight metals were identified as COPCs in the human health risk assessment.

PCBs: No PCBs were detected in deep unit groundwater.

NAPLs: LNAPLs or DNAPLs were not observed in deep unit monitoring wells.

2.5.4 Sump

Sumps were identified in Buildings #2, #4 (demolished), and #17 and were sampled in conjunction with groundwater sampling events. The results were compared to groundwater PAL although, as noted below, several sumps do not contain groundwater.

The Building #2 sump is in the basement and has a pump with an on/off float that conveys water to a sewer pipe. The water in the sump was sampled twice. No odors or sheen were noted at the time of sampling. Chloroform, benzo(a)pyrene, arsenic, sodium, and Aroclor 1260 were reported at concentrations above respective PALs. Aroclor 1260 and benzo(a)pyrene were only detected once above PALs. It is noted that several VOC results were rejected and unusable as quantified results. The closest monitoring well (E-9) to this sump had similar chloroform concentrations and no other VOC PAL exceedances consistent with the Building #2 sump. Chloroform was detected (0.98 microgram per cubic meter [$\mu g/m^3$]) in the Building #2 basement indoor air. The Building #2 sump is below grade and regularly pumps water, indicating it may be communicating with the shallow fill unit groundwater.

The Building #4 sump is in the floor slab of the demolished Building #4. At the beginning of the RI, vehicle dismantling occurred on the former Building #4 concrete slab. The sump is exposed to weather, and no VOCs were reported above groundwater PALs. Several SVOCs and metals were above PALs. Aroclor 1260 was detected above its PAL. The contents of the sump represent precipitation runoff from the Building #4 floor slab and not groundwater.

There are two sumps inside the vacant, deteriorating Building #17. The sumps are in the bottom floor which is partially below grade. This floor becomes submerged by water after precipitation events resulting in a determination that the liquids in the sumps are suspected to be related to precipitation entering into the building and not groundwater. No VOCs were above the groundwater PALs. No PCBs were detected. 1,4-Dioxane (Sump 2 only) and several metals were above groundwater PALs. Additional details on sump results are provided in RIR Section 4.5.

2.5.5 Sewer

The assessment of the sewer system resulted in the collection of water samples at four Lot 1 manholes. Samples from Manholes 17 and 20 were from active sewers where site tenants/owners are discharging to these publicly owned treatment works (POTW) sewers.

Three of the four sewer water samples had no PAL exceedances. Manhole 8 (Lot 1) had methylene chloride and TCE above the PALs. A solid sample collected from Manhole 8 contained methylene chloride and toluene concentrations that were above 1 mg/kg. Two SVOCs and several metal concentrations were above 1 mg/kg. The sewer at this location was classified as inactive based on observations of no flow and lack of current users upstream of the location.

The water and solid results at Manhole 8 were higher than nearby groundwater concentrations. The source of VOCs in this manhole is unknown but a former recent operator used VOCs in its manufacturing operations. This is an inactive sewer at this location and, based on results, its contents would be a source material, if released into the environment. Based on RI results, other sewer locations are not sources of groundwater or soil/fill impacts reported in the RI. Additional details on sewer results are provided in RIR Section 4.6.1.

2.5.6 Lot 57/Sewer Pipe and Groundwater

The Lot 57 wall sewer sample contained elevated toluene and acetone concentrations. Other VOC results were rejected due to holding time exceedances, except for toluene and acetone. The acetone concentration was 83,000 µg/L. Concentrations of ethyl acetate (a tentatively identified compound [TIC]) was estimated to be 7,000 µg/L. TIC concentrations are estimates because the target compound is tentatively identified by the laboratory instrument. Additional details on Lot 57 sewer water results are provided in RIR Section 4.6.2.

The nearest shallow fill well (MW-118) to the wall sewer sample had acetone concentrations from 51,000 to 71,000 µg/L. Ethyl acetate was not identified as a TIC in this well. Ethanol and isopropyl alcohol had the highest concentrations of VOC TIC reported in this well.

The deep unit well (MW-204) adjacent to MW-118 was non-detect for acetone and ethyl acetate. Ethanol and isopropyl alcohol were not identified as TICs in this deep well.

In the wall sewer sample, SVOCs and PCBs were below PALs with one metal (lead) exceeding the PAL. Various metals were present at concentrations below 50 µg/L in the wall water sample.

The flow from the pipe increased during sampling, indicating that the source may not always be a passive source. An additional VOC sample can be collected to more fully characterize this water, but the presence of acetone and likely ethyl acetate in the wall sewer pipe and acetone in shallow groundwater indicates this water in the pipe and well should be evaluated in the FS to assess whether manufacturing activities in Building #10 are contributing to groundwater and surface water contamination.

2.5.7 Indoor Air

Indoor air and exterior ambient air samples were collected and analyzed from occupied buildings (Buildings #1, #2, #3, #9, #10, #14, and #16) during the heating season (as defined by NJDEP). The samples were analyzed for benzene, ethylbenzene, xylenes, 1,1,2-TCA, carbon tetrachloride, chloroform, isopropylbenzene, naphthalene, TCE, and vinyl chloride.

Benzene concentrations were above the benzene PAL (0.36 µg/m^3) in each building's indoor air samples and in ambient air. Chloroform was above its PAL in Buildings #2, #10, and #14. Ethylbenzene and TCE concentrations in Building #1 were above PALs. Other parameters were not above a PAL. In addition to benzene, xylenes were detected in ambient air.

The three highest VOC concentrations in ambient air are as follows:

- 0.99J µg/m^3 - m,p-Xylene
- 0.76J µg/m^3 - Benzene
- 0.45J µg/m^3 - o-Xylene

Operations in several buildings (Buildings #9, #10, #14 and #16) sampled use organic solvents in their process or routinely have gasoline/diesel-powered vehicles/equipment stored in the building sampled. Gasoline/diesel equipment was not operating during sampling. RIR Section 4.7 provides additional details on indoor and ambient air samples.

2.6 Existing Institutional and Engineering Controls

Portions of five lots within the Site are currently subject to NJDEP Deed Notice/Declaration of Environmental Restriction (DER), which are institutional controls that limit use of the properties to non-residential uses. Also, several CEAs are established or proposed under NJDEP-led remediations (Figure 2-2). CEAs proposed but not approved by NJDEP are not on Figure 2-2 and were not considered in the risk assessments.

Lot 1

A historic fill CEA (arsenic, iron, lead, manganese, and sodium) was proposed for Lot 1 in 2017 by Samax under New Jersey PI #563216. Samax is awaiting direction from USEPA on implementation of the CEA.

Lot 60

In 2017, a historic fill CEA was submitted to NJDEP on behalf of Roloc for Lot 60. The CEA indicated mercury, arsenic, aluminum, chromium, iron, and lead concentrations were above the NJDEP GWQS. The Responsible Party is awaiting direction from USEPA on implementation of the CEA.

Lot 61

The deed notice filed by the property owner (City of Newark) indicates there is potential for encountering contaminated historic fill beneath Building #6 on Lot 61 (Figure 2-2). The concrete building slab is identified as an engineering control. The Responsible Party associated with the deed notice is Honeywell, successor to BBI. The deed notice identifies contaminants associated with the historic fill as being VOCs and metals. The New Jersey PI number is G0000005586.

Lot 63

A 2008 deed notice identifies two areas on Lot 63 beneath the footprint of Building #7 on the north and east sides as being potentially impacted by historic fill, with the building slab acting as an engineering control (Figure 2-2). Honeywell is the Responsible Party for maintaining the engineering control. The New Jersey PI number is G0000005586.

Lot 67

The southwestern portion of Lot 67 is under a groundwater CEA and deed notice with engineering controls to address groundwater impacts and soil/fill contamination related to historic fill and a Lot 68 PCE spill (Figure 2-2). Honeywell is responsible for maintaining the CEA, as well as the engineering controls. The New Jersey PI number is G0000005586.

Lot 68

Lot 68 is a New Jersey known contaminated site (NJDEP Case No. 88434). A deed notice with an engineered asphalt/concrete cap is present related to shallow soil/fill impacts of arsenic, lead, PCE, TCE, and zinc. There is also a groundwater CEA covering *cis*-1,2-DCE, *trans*-1,2-DCE, PCE, TCE, and vinyl chloride (Figure 2-2). Honeywell is responsible for maintaining the CEA, as well as the engineering controls. The New Jersey PI number is G0000005586.

Lot 69

An abandoned off-site petroleum bulk storage facility to the north of Lot 69 has a CEA that extends onto Lot 69. The CEA is for benzene; however, benzene was below the NJDEP GWQS in the on-site portion of the CEA area during the RI.

Lot 70

Lot 70 May 1998 DER was terminated and replaced by a deed notice recorded on December 4, 2014, restricting the Site to non-residential use only. In August 2014, engineering controls (4-inch-thick asphalt cap over the entire exterior of the parcel) were installed and are included in the deed notice. A 2010 historic fill CEA (arsenic, barium, benzene, cadmium, lead, and zinc) was established for Lot 70.

2.7 Fate and Transport

VOCs, SVOCs (represented by PAH compounds and PHCs), metals, PCBs, and TCDD have been detected in soil/fill and groundwater.

Biodegradation of some compounds like VOCs is rapid. SVOCs and metals at the Site are less susceptible to degradation and, therefore, are relatively persistent in the environment. The RI did not include a monitored natural attenuation (MNA) study at the Site. In addition to biodegradation, the chemical solubility, volatility, and its tendency to absorb to soil/fill, all affect the fate and movement through soil/fill and groundwater.

Potential transport interactions at the Site include the following:

- Overland stormwater

- UST contents to groundwater
- Soil to groundwater
- One sewer manhole to soil/groundwater
- Groundwater - surface water interaction
- River - site soil interaction
- Soil gas to indoor air
- Soil to airborne dust
- One sewer pipe (P57-1)

Additional details on fate and transport are provided in RIR Section 5.

2.8 Risk Assessments

The BHHRA and SLERA for the Site were prepared by Ramboll and were reviewed and approved by USEPA. The documents provide the full details on these assessments. Both risk assessments were performed without consideration of existing or planned engineering and institutional controls and followed USEPA guidance, guidelines, and policies. The Risk Characterization sections of each document summarize the results of the assessment.

The BHHRA evaluated cancer risks and non-cancer hazards to various receptors (e.g., outdoor worker, indoor worker, etc.) under current and future land uses assuming reasonable maximum exposures to the receptors. The Risk Characterization (Section 6) summarizes the risks to the various receptors under current and future land uses. Based on the results of the BHHRA, response actions are being evaluated for unacceptable human health risks and will address copper (Lot 63), lead (Lots 1, 61, 62, 63, 64, 65, 68, and 70), VOCs (Lots 58 and 68), and naphthalene (Lot 62) contamination. The response action for these contaminants and areas will consider potential ecological risks identified in the SLERA. Additional response actions will be evaluated for Lots 67 and 69, where there were no estimated human health risks above the upper-bound of the USEPA National Contingency Plan (NCP) risk range, and the non-cancer protection goal of a HI = 1, but the SLERA identified unacceptable ecological risks with hazard quotients (HQs) greater than 1 in surface soil/fill (refer to Figure 2-6). Lastly, as described in more detail in Section 3.4, this FS includes a comparison of Site COPC concentrations across the Site to ARARs.

Human Health Risk Assessment Summary

The significance of potential exposures to concentrations of COPCs in soil/fill, indoor air, and groundwater was evaluated based on estimates of reasonable maximum exposure (RME) under current and potential future land use at the Site. The significance of potential exposures was determined by comparing estimates of cumulative cancer risks to the USEPA NCP risk range (10^{-4} to 10^{-6}) and non-cancer HI to the protection goal of HI = 1. The BHHRA was conducted in the absence of remedial action and additional institutional controls.

Under current land use, the potentially exposed receptors at and around the Site are assumed to include outdoor workers (only at occupied Lots 1, 57, 59, 60, 62, 69, and 70), indoor workers (only at occupied lots), utility workers, construction workers (only at lots slated for redevelopment in the near future, which are Lots 57, 58, 61, 63, 64, 68, and 70), trespassers, visitors (only at occupied lots), and off-site workers and residents (via wind transport).

Under future commercial/industrial land use, the potentially exposed RME individuals at and around the Site are assumed to be the same as those for current land use, except that exposures to impacted media within each of the 15 properties, regardless of whether currently developed or not, is evaluated for all receptors (i.e., receptors may be present at redeveloped lots). The potentially exposed RME individuals at and around the Site are assumed to include outdoor workers, indoor workers, utility workers, construction workers, trespassers, visitors, off-site workers (via wind transport and future shallow groundwater migration), and off-site residents (via wind transport).

As required by USEPA, in addition to the above scenarios evaluated assuming the continued foreseeable use of the Site for commercial/industrial purposes, the BHHRA includes a future hypothetical residential scenario which assumes the Site will be redeveloped and have medium-density residential units. Additionally, hypothetical potable shallow and deep groundwater use is evaluated for on- and off-site workers, visitors, and residents to facilitate development of appropriate institutional controls for the Site.

Any COPC in soil/fill under a current and/or future commercial/industrial land use that has cumulative cancer risks greater than the USEPA NCP risk range (10^{-4} to 10^{-6}), or non-cancer HIs greater than the protection goal of HI = 1, or for lead, exceedance of 800 mg/kg (USEPA Region 2 non-residential screening level) or greater than a 5 percent probability that estimated blood lead levels are above 5 micrograms per deciliter (µg/dL), is retained for further evaluation under a current and/or future scenario. These conclusions remain the same for the future land use scenario in which soil/fill below the 0 to 2 ft depth interval (or 0 to 4 ft depth interval for utility worker) may be brought to the surface in the course of Site redevelopment, except for the select points with elevated concentrations of lead identified in the BHHRA outlier analysis. This analysis identified three locations from Lot 64 (B-75 at 1 to 3 feet bgs of 8,690 mg/kg, B-74 at 3 to 4 feet bgs of 3,080 mg/kg, and B-70 at 5 to 7 feet bgs of 3,020 mg/kg, which are adjacent to Lot 63) that could affect the conclusions of the risk assessment for a future outdoor worker and trespasser exposure to lead in soil/fill from the subsurface that may be brought to the surface during Site redevelopment. Although prolonged exposure to these locations in isolation is not anticipated, they are retained for further evaluation in the FS.

The following table lists soil/fill COPCs and receptors under current and future conditions that were retained for evaluation in this FS. These are presented for both lots associated with excess risk, as well as specific points identified in the BHHRA outlier analysis associated with excess risk.

Lot	Receptor	COPC	Lead Exceeded Action Level or Blood Lead Level (refer to BHHRA Section 6.2 for detail)
Current Scenarios			
1	Visitors	Lead	Blood Lead Level
61	Construction worker	Lead	Blood Lead Level
62	Visitors	Lead	Blood Lead Level
63	Trespasser	Lead	Both
	Construction worker		Both
	Utility worker		Action Level
64	Construction worker	Lead	Blood Lead Level
	Trespasser (outlier/hot spot location B-75)		Action Level
68	Construction worker	Lead	Blood Lead Level
70	Construction worker	Lead	Both
	Trespasser		Both
	Outdoor worker		Both
	Visitor		Blood Lead Level
	Indoor worker		Action Level
	Utility worker		Action Level

Lot	Receptor	COPC	Lead Exceeded Action Level or Blood Lead Level (refer to BHHRA Section 6.2 for detail)
Future Scenarios			
1	Visitor - child	Lead	Blood Lead Level
58	Indoor worker (vapor intrusion)	TCE, xylenes	--
61	Construction worker	Lead	Blood Lead Level
62	Indoor worker (vapor intrusion)	Naphthalene	--
	Construction worker	Lead	Blood Lead Level
	Visitor - child		Blood Lead Level
63	Outdoor worker	Lead	Both
	Indoor worker (dust)		Both
	Trespasser		Both
	Construction worker		Both
	Visitor - child		Both
	Utility worker		Action Level
	Visitor - child	Copper	--
64	Construction worker	Lead	Blood Lead Level
	Visitor - child		Blood Lead Level
	Outdoor worker (outlier/hot spot locations B-70, B-74, and B-75)		Action Level
	Trespasser (outlier/hot spot locations B-70, B-74, and B-75)		Action Level
65	Construction worker	Lead	Blood Lead Level
	Visitor - child		Blood Lead Level
68	Construction worker		Blood Lead Level
	Visitor - child	Lead	Blood Lead Level
	Indoor worker (vapor intrusion)	TCE	--
70	Outdoor worker	Lead	Both
	Trespasser		Both
	Construction worker		Both
	Visitor - child		Both
	Indoor worker		Action Level
	Utility worker		Action Level

Risks associated with potable use of shallow and deep groundwater, if it were to occur in the future, are also unacceptable (refer to Table 3-1). Although groundwater is designated as Class IIA, future potable use of shallow groundwater at the Site is not expected, since the Site and surrounding area are served by the City of Newark's potable water system, and the site-specific conductivity readings of the shallow groundwater indicate possible brackish conditions. However, as described in more detail in Section 3.7.3, PRGs, in the form of ARARs, were identified for all of the groundwater COPCs with hypothetical risk, and response actions to address these groundwater risks were identified in this FS.

Screening Level Ecological Risk Assessment

The SLERA used the site characterization data that were collected during the RI to assess potential risks to ecological receptors that may be exposed to Site-related constituents in surface soil/fill. Only surface soil/fill samples within or adjacent to areas identified as within potential ecological habitat were included in this SLERA.

Findings of the SLERA are as follows:

- Approximately 70 percent of the Site is covered with impervious surfaces, and <30 percent of this Site is pervious and may support potential ecological habitat. Some areas within the pervious portion have developed fragmented and low-value ecological habitat populated with mostly opportunistic, invasive, and transient species, such as Japanese knotweed (*Fallopia japonica*).
- Terrestrial exposure pathways for plants, soil invertebrates, birds, and mammals are potentially complete for a small portion of the Site. Primary exposure pathways include direct contact (e.g., plant roots and soil invertebrates), soil ingestion (e.g., earthworms), incidental soil ingestion (e.g., preening), and prey ingestion. For wildlife, prey ingestion is assumed to dominate exposure.
- Due to the limited, fragmented, and low-quality ecological habitat available on-site and the proximity to active industrial and commercial operations, it is unlikely that Federal-listed or State-listed sensitive species would be present on-site.
- Selected receptors of interest for the SLERA consisted of terrestrial plants, soil-associated invertebrates, and terrestrial-feeding birds and mammals.
- Assessment endpoints for the SLERA consisted of maintenance of the current: (1) community structure and function level for plants and invertebrates; and (2) survival and reproduction levels for terrestrial-feeding birds and mammals. Exposure point concentrations (EPCs) used in the SLERA were the maximum concentrations of chemicals detected in surface soil locations within or adjacent to areas identified as within potential ecological habitat.
- Measurement endpoints for the SLERA were New Jersey ecological screening criteria (ESCs). Maximum concentrations of constituents in surface soils were compared to ESCs, and constituents with maximum concentrations higher than ESCs were identified as chemicals of potential ecological concern (COPECs) requiring further investigation.

The SLERA identified the following COPECs in surface soil:

- VOCs: acetone, chloroform, cumene, cyclohexane (no criteria), ethyl benzene, 2-hexanone, methyl acetate (no criteria), methylcyclohexane (no criteria), toluene, TCE, and total xylenes.
- SVOCs: PAHs (both low and high molecular weight), benzaldehyde (no criteria), 1,1-biphenyl, carbazole, dibenzofuran, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, dimethylphthalate, and di-n-butylphthalate.
- Pesticides: heptachlor epoxide.
- PCBs and dioxins: Total PCBs, PCB-1254, PCB-1260, and PCB-1262, and 2,3,7,8-TCDD exceeded ESCs.
- Metals: antimony, barium, cadmium, chromium, cobalt, copper, cyanide, iron (no criteria), lead, manganese, mercury, nickel, selenium, vanadium, and zinc.

Although several COPECs have been identified in this SLERA, the likely future use of this Site is to remain developed for commercial/industrial purposes. The industrial nature of the Site limits the amount of available ecological habitat, as well as influences the quality of that habitat. Redevelopment of any portion of the Site will remove or alter the existing ecological resources in that area.

While the findings of the SLERA identified the potential for unacceptable ecological risk, no additional ecological investigation is needed, provided that the proposed remedial alternatives will address the COPECs associated with HQs greater than 1 in surface soil/fill, and that remediation goals that are protective of ecological receptors are used. Additional response actions will be evaluated for Lot 67 and Lot 69, where the SLERA identified unacceptable ecological risk with HQs greater than 1 in surface soil/fill but excess risks for human health were not observed. Below is the list of COPECs for these two undeveloped parcels based on exceedances of ESCs.

ECOLOGICAL COPECs

Volatile Organic Compounds (VOCs)

- Cumene
- Ethyl Benzene
- 2-Hexanone
- Toluene
- 1,1,1-Trichloroethane
- Xylenes (total)
- PAHs (High molecular weight)
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- bis(2-Ethylhexyl)phthalate
- Carbazole
- Chrysene
- Dimethylphthalate
- Di-n-butylphthalate
- Fluoranthene
- Indeno(1,2,3-cd)pyrene
- Pyrene

Polychlorinated Biphenyls (PCBs)

- Total PCBs
- PCB-1262
- PCB-1254
- PCB-1260

Inorganics

- Aluminum
- Antimony
- Barium
- Cadmium
- Chromium (total)
- Chromium VI
- Copper
- Cyanide (total)
- Lead
- Manganese
- Mercury
- Nickel
- Selenium
- Vanadium
- Zinc

Additional Chemicals

- 2,3,7,8-TCDD

2.9 Reuse Assessment

The reuse assessment involved collecting and evaluating information to develop assumptions regarding the types or broad categories of reuse that might reasonably occur at a Superfund Site (e.g., residential, commercial/industrial, recreational, and ecological), so that cleanup standards and remedies can be tied to reasonably expected future land use. The findings of the reuse assessment indicated that both the current and reasonably anticipated future land use at the Site are consistent with industrial, non-residential uses.

2.10 Cultural Resource Survey

The findings of the Phase 1A Cultural Resource Survey (CRS; NV5, Inc., 2017) indicated that no archaeological resources that might meet the evaluation criteria for inclusion in the National Register are present within the Site. No further archaeological study is recommended.

2.11 Response Action Evaluations

Based on the risk assessments and ARAR compliance, response actions for those media potentially posing unacceptable human health risks and/or risks to the environment will be evaluated in the FS. In addition, waste is a non-environmental media that will also be addressed in the FS as potential source material.

3. OBJECTIVES AND REQUIREMENTS OF SITE REMEDIATION

This section introduces the requirements and objectives that remedial actions are to achieve based on the risks identified in the BHHRA and SLERA. In addition, concentrations of COPCs in soil/fill and groundwater were compared to numeric ARARs, including the New Jersey Nonresidential Direct Contact Soil Remediation Standards (NRDCSRS) for soil and, for groundwater, the NJDEP GWQS, NJDEP MCLs, and USEPA MCLs for drinking water. NJDEP VISLs are to be considered (TBC) and are compared separately to groundwater concentrations. These comparisons, which were performed as an additional evaluation in this FS, are provided in Section 3.4. RAOs specify how the cleanup will protect human health and the environment and serve as the basis for the development of remedial action alternatives. The process of developing the RAOs follows the identification of affected media, contaminant characteristics, contaminant migration, exposure pathways, and receptor exposure levels. To achieve the RAOs, PRGs are developed as the benchmarks for the technology screening process and the assembly, screening, and detailed evaluation of alternatives.

3.1 Identification of COPCs and COPECs in BHHRA and SLERA

Several contaminants were identified as COPCs in the BHHRA and COPECS in the SLERA. These COPCs and COPECs pose unacceptable human health and/or ecological risks under current and/or future use scenarios, are addressed in the FS and are listed below. Identification of other COPCs by comparison to ARARs (and TBC in the absence of ARARs) is provided in Section 3.4.

3.1.1 Soil/Fill

On select lots, BHHRA findings indicate that copper and lead are the soil/fill COPC that pose unacceptable human health risks under current and/or future use scenarios. The presence of these contaminants in soil/fill on remaining lots was also evaluated to determine the potential need for response actions.

As listed in the BHHRA and shown on Figure 2-6, lead is a COPC that has unacceptable risks/hazards on Lots 1, 61, 62, 63, 64, 65, 68, and 70. Copper associated with unacceptable human health hazard (future visitor child) and ecological risk is collocated with lead-impacted soil/fill (Lot 63).

Ecological COPECs are listed in Section 2.8 for Lot 67 and Lot 69.

3.1.2 Groundwater

As stated in the RIR, groundwater is not currently used for potable water and is not reasonably expected to be used as a potable source in the future. However, the aquifer underlying the Site is classified by NJDEP as Class IIA, regardless of whether the groundwater is currently being used as a potable source. Hypothetical future potable use of groundwater is presented in the BHHRA for the purpose of ensuring that the FS includes one or more alternatives that are protective of this exposure pathway. Table 3-1 presents a list of groundwater COPCs identified in the BHHRA as posing risks/hazards above the USEPA acceptable levels for the following exposure pathways: potable use of shallow groundwater, and potable use of deep groundwater.

3.1.3 Soil Gas

The BHHRA indicates that soil/fill concentrations of naphthalene, TCE, and xylenes could present unacceptable risks/hazards to future indoor workers from potential soil gas intrusion (modelled from soil/fill concentrations) on three lots (Lots 58, 62, and 68), should these currently vacant areas be subject to improvement via construction of new buildings or occupation of existing vacant buildings. The presence of these contaminants in soil/fill on remaining lots was also evaluated to determine the potential need for response actions.

3.1.4 Sewer Water

Manhole 8 is an inactive sewer that consists of nine 4-inch diameter steel pipe terminations. Only one of the pipes (Line L) is not blocked. Concentrations of TCE, methylene chloride, benzo(a)pyrene, lead, and manganese were detected in water from Manhole 8 on Lot 1 along with elevated concentrations of methylene chloride, toluene, and TCE in the associated solids. Sewer water and solids are currently contained within Manhole 8 and were not evaluated in the BHHRA.

3.2 ARARs and TBCs

ARARs and numeric PRGs are components of the RAOs. As appropriate, TBCs can be used to develop PRGs in the absence of ARARs. This section describes these terms and their implications for RAO and GRA development and subsequent alternatives analysis.

The national goal of remedy selection is to protect human health and the environment, to maintain that protection over time, and to minimize untreated waste (40 Code of Federal Regulations [CFR] Part 300.430 of the NCP). In accordance with Section 121(d) of CERCLA, 42 U.S.C. § 9621, site remediation must comply with all applicable or relevant and appropriate laws, regulations, and standards promulgated by the federal government, except where waived. Substantive state environmental and facility siting requirements must also be attained, under Section 121(d)(2)(c) of CERCLA, 42 U.S.C. § 9621, if they are legally enforceable and consistently enforced statewide, and if the state standard is more stringent than the federal standard. If a state is authorized to implement a program in lieu of a federal agency, state laws arising out of that program provide the “applicable” standards. However, federal standards of that program that are more stringent may be considered “relevant and appropriate.” TBCs are non-promulgated guidance and policy documents, advisories, and other criteria that do not have the enforcement status of ARARs but support the development and evaluation of remedial alternatives. While TBCs are not promulgated or enforceable, TBCs may be consulted to interpret ARARs or to establish PRGs when ARARs do not exist for particular contaminants or do not sufficiently eliminate identified risks.

Section 121(e) of CERCLA, 42 U.S.C. § 9621, also codified in the NCP at 40 CFR Part 300.400(e), exempts any response action conducted entirely on site from having to obtain federal, state, or local permits, where the action is carried out in compliance with Section 121. Remedial actions conducted on CERCLA sites need to comply only with the substantive aspects of laws that qualify as ARARs and not with the corresponding administrative requirements.

As defined by the NCP, ARARs are placed into two classifications: applicable requirements and relevant and appropriate requirements. The two classifications are defined as follows:

- Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site. State standards that are more stringent than federal requirements may be applicable.

- Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site, address problems or situations sufficiently similar (relevant) to those encountered at the CERCLA site that their use is well suited (appropriate) to the particular site.

The term “relevant” was included so that a requirement initially screened as non-applicable because of jurisdictional restrictions could be reconsidered and, if appropriate, included as an ARAR for a given site. For example, MCLs would not be applicable, but are relevant and appropriate for a site with groundwater contamination in a potential (as opposed to an actual) drinking water source. A requirement may be either "applicable" or "relevant and appropriate," but not both. There are three categories of ARARs: chemical-specific, location-specific, and action-specific.

- Chemical-specific ARARs (Table 3-2) are numeric values that provide criteria for evaluating concentrations of specific hazardous contaminants and are developed based upon protection of human health and the environment. These values establish the acceptable amount or concentration of a chemical that may be found in or discharged to the environment. Chemical-specific ARARs provide a basis for the development of numerical PRGs. For the purpose of this FS, chemical specific ARARs include New Jersey standards (NRDCSRS) for soil and NJDEP GWQS, NJDEP MCLs, and USEPA MCLs for groundwater.
- Location-specific ARARs (Table 3-3) serve to protect individual characteristics, resources, and specific environmental features, such as wetlands, water bodies, floodplains, and sensitive ecosystems. Location-specific ARARs may affect or restrict remediation and appurtenant activities. The general types of location-specific requirements that may be applied to the Site include floodplain and waterfront development regulations.
- Action-specific ARARs (Table 3-4) are technology- or activity-based requirements of activities or processes, including storage, transportation, and disposal methods of hazardous substances as well as construction of facilities or treatment processes. Action-specific ARARs are defined by the components of a potential remedy and will be discussed as appropriate for each remedial alternative during detailed evaluation of alternatives.

The identification of ARARs began during the initial scoping of RAOs and GRAs and is completed during alternatives development. Tables 3-2, 3-3 and 3-4 lists ARARs and TBCs for the Site by each of the three categories described above. TBCs include non-promulgated criteria, advisories, guidance, screening levels, and proposed standards issued by Federal or State governments. TBCs are not potential ARARs because they are neither promulgated nor enforceable.

In August 2016, USEPA issued a memorandum titled “Consideration of Greener Cleanup Activities in the Superfund Cleanup Process” that provides guidance on the use of Green and Sustainable Remediation in the CERCLA site remediation process. The memorandum states that “In addition to ensuring that CERCLA response actions are protective of human health and the environment, the Agency may consider a number of factors when evaluating remedial action alternatives, including response actions’ potential environmental impacts, mitigative measures’ effectiveness and reliability during implementation, and innovative technologies’ use.”

3.3 Statutory Waivers for ARARs

CERCLA Section 121 (d) provides that under certain circumstances an ARAR may be waived. The six statutory waivers are as follows:

- **Interim Measure:** Occurs when the selected remedial action is only part of a total remedial action that will attain ARARs when completed.
- **Greater Risk to Health and the Environment:** Occurs when compliance with such requirements will result in greater risk to human health and the environment than noncompliance.
- **Technical Impracticability:** Occurs when compliance with such requirements is technically impracticable from an engineering perspective.
- **Equivalent Standard of Performance:** Occurs when the selected remedial action will provide a standard of performance equivalent to that required under the otherwise applicable standard, requirement, criteria, or limitation through use of another method or approach.
- **Inconsistent Application of State Requirements:** Occurs when a state requirement has been inconsistently applied in similar circumstances at other remedial actions within the state.
- **Fund-Balancing:** Occurs when, in case of an action undertaken using Superfund resources, the attainments of the ARAR would entail extremely high costs relative to the added degree of reduction of risk afforded by the standard such that remedial actions at other sites would be jeopardized.

3.4 Chemical-Specific ARAR Evaluation

This section compares contaminants that were identified at the Site, but do not necessarily give rise to unacceptable risks/hazards, to ARAR values to identify any additional COPCs for further evaluation in this FS. Detected soil/fill and groundwater constituents site-wide were evaluated with respect to chemical-specific ARARs.

EPA's determination that the reasonably anticipated future use of the Site is commercial/industrial is supported by City of Newark 2013 Public Access and Redevelopment Plan (City of Newark, 2013). Therefore, for soils/fill, because the Site is non-residential/industrial and the projected future use is anticipated to remain unchanged, NRDCSRS were used as the soil/fill ARAR. NJDEP "Guidance Document for Development of Impact to Groundwater Soil Remediation Standards" was considered as a TBC; however, site-specific IGWSSLs were not developed for a soil/fill comparison because ARARs were available.

For groundwater, single-point compliance was used for comparison to ARARs. The complete RIR groundwater data set was used and compared to the lowest value of NJDEP GWQS, NJDEP MCLs, and USEPA MCLs. When the remedial design occurs, groundwater quality will be updated and remedial design results will be used to revise the ARAR comparison, as necessary, for the selected groundwater alternative.

3.4.1 Soil/Fill

Individual soil/fill results for a single sample location were compared to applicable chemical-specific ARARs (refer to Table 3-5A and Table 3-5B for soil data). The embedded table below provides a cross-reference to figures showing the exceedances.

COPC	ARAR (mg/kg)	ARAR Comparison Figure
Arsenic	19	3-1
Benzene	5	3-2
Benzo(a)anthracene	17	3-3
Benzo(a)pyrene	2	3-4

COPC	ARAR (mg/kg)	ARAR Comparison Figure
Benzo(b)fluoranthene	17	3-5
Dibenz(a,h)anthracene	2	3-6
Lead	800 (also PRG value)	3-7
Manganese	5,900	3-8
Naphthalene (soil ARAR, not related to soil gas)	17	3-9
PCB-1254	1	3-10
PCB-1260	1	3-11
PCB-1262	1	3-12
Trichloroethene (soil ARAR, not related to soil gas)	10	3-13
Vinyl Chloride	2	3-14
Iron	55,000	No figure presented

Soil/fill impacted by NAPL will be compared to NJDEP extractable petroleum hydrocarbon (EPH) ARARs and delineated per the NJDEP guidance. NJDEP classifies petroleum into two categories: Category 1 is for No. 2 heating oil and diesel fuels and Category 2 is for a variety of other petroleum products, including but not limited to No. 4 heating oil, No. 6 heating oil, and manufactured gas plant products. Remedial action is warranted if EPH concentration exceeds 8,000 mg/kg for Category 1 petroleum or crude oil (which is a source of No. 2 heating oil), or if the EPH concentration exceeds 17,000 mg/kg for Category 2 petroleum. For non-residential use, NJDEP uses an EPH cleanup criteria of 54,000 mg/kg for No. 2 heating oil. The free product limit for No.2 heating oil is 8,000 mg/kg. For No. 6 heating oil, NJDEP has health-based criterion calculators for fractionated EPH concentrations, in addition to the default and site-specific free product limit calculator. The NJDEP guidance “Evaluation of Extractable Petroleum Hydrocarbon in Soil Technical Guidance” provides a step-wise procedure for delineating and testing impacted soil.

3.4.2 Groundwater

Detected groundwater results were compared to ARARs. Table 3-6 summarizes ARAR exceedances in groundwater. The ARAR was the lower of NJDEP GWQS, NJDEP MCLs, and USEPA MCLs. Although groundwater is designated as Class IIA, potable use of shallow groundwater at the Site is unlikely since the Site and surrounding area are served by the City of Newark’s potable water system, and the site-specific conductivity readings of the shallow groundwater indicate possible brackish conditions. Regardless, the ARAR comparisons were performed to assist in evaluating potential response actions to meet RAOs.

Shallow Fill Unit

Shallow fill groundwater ARAR exceedances from all RI groundwater samples are shown on the following figures:

Figure 3-15: 1,1,2-TCA Groundwater Sampling Results - Fill Unit
Figure 3-16: 1,4-Dioxane Groundwater Sampling Results - Fill Unit
Figure 3-17: Acetone Groundwater Sampling Results - Fill Unit
Figure 3-18: Antimony Groundwater Sampling Results - Fill Unit
Figure 3-19: Arsenic Groundwater Sampling Results - Fill Unit

The following COPCs were also detected above ARARs in the shallow groundwater unit in one or more groundwater sampling events (no figure is provided; refer to Table 3-6):

- 1,2-Dibromo-3-chloropropane
- 1,1,2,2-Tetrachlorothane
- TCE
- Bis(2-ethylhexyl)phthalate
- Aluminum
- Iron
- 1,3-Dichloropropene (trans)
- Methylene chloride
- Vinyl chloride
- Benzo(b)fluoranthene
- Barium
- Selenium
- Sodium
- 2-Hexanone
- Tetrachloroethene
- 2-Methylnaphthalene
- o-Xylene
- Beryllium
- Manganese
- 1,2,4-Trichlorobenzene

The detection of aluminum, iron, manganese, and sodium above ARARs was widespread in the most recent sample results.

Deep Unit

The deep groundwater was only sampled once in the RI. Groundwater concentrations in the deep unit were lower than the shallow fill unit. In the deep unit, 1,1,2-TCA (Figure 3-32), benzo(a)anthracene (Figure 3-32), 1,1,2,2-tetrachloroethane (Figure 3-33), PCE (Figure 3-33), benzene (Figure 3-34) and 1,4-dioxane (Figure 3-34) exceeded ARARs. Other metals that exceed ARARs in the deep groundwater monitoring wells included: iron, arsenic, manganese, and sodium (no figures are provided; refer to Table 3-6). Lead was not detected above its ARAR (5 µg/L) in the deep unit (Figure 3-34).

Vapor Intrusion from Shallow Fill Unit

The BHHRA vapor intrusion modeling indicated that there were no unacceptable health risks/hazards (modelled from shallow groundwater concentrations). However, a comparison of the shallow fill unit data to NJDEP's VISLs Guidance identified benzene, ethylbenzene, total xylenes, 1,3-dichloropropene (total), TCE, and vinyl chloride at concentrations above NJDEP VISL levels (refer to Table 3-1). While VISLs are a TBC, an exceedance would trigger an investigation for an occupied building within 100-feet of the monitoring well.

3.5 Identification of Contaminated Media

Based on the results of the RI, BHHRA, and SLERA, as well as the comparisons to ARARs performed in the previous section, risks to human health, welfare, and the environment posed by the identified COPCs in waste, soil/fill, soil gas, groundwater, and sewer water may warrant the need for remedial action.

3.5.1 Waste

As discussed in the RIR, "waste" includes containerized waste, LNAPL in USTs and Building #15A, and solids in Manhole 8, and only acts as a potential source material if released into the environment. Containerized waste and LNAPL in USTs and Building #15A are addressed by remedial alternatives (Section 5.1). LNAPL in a UST is considered to constitute a principal threat waste. NAPL-impacted soil/fill adjacent to the USTs is managed with the waste remedial alternatives (Section 5.1). Manhole 8 solids are addressed in conjunction with sewer water (Section 5.4).

Based on results for water in Building #15 and the contents in the active sewer system, neither is classified as a potential source material or principal threat waste. Sumps in Building #17 and former Building #4 collect precipitation. Based on the RI results and the source of water in sumps, the sump contents do not require remedial action. Building #2 sump is an active water control measure for the Buildings #2 and #3 basements which are occupied. Because the sump water is pumped into a pipe connected to the Passaic Valley Sewerage Commission (PVSC) system, this sump is not subject to remedial action.

NAPL-impacted soil/fill not directly associated with a UST is also discussed in Section 3.5.2 and the corresponding Soil/Fill Alternatives (Section 5.2). LNAPL in USTs is considered to constitute a principal threat waste.

3.5.2 Soil/Fill

Soil/fill in select areas contain site COPCs in surface and subsurface soil/fill that exceed ARARs (Section 3.4.1) and/or pose unacceptable risks per the BHHRA or SLERA (Section 3.1.1). PRGs are developed for these soil/fill COPCs to ensure that remedial alternatives are protective of human health and the environment and comply with CERCLA requirements (Section 3.7). Soil/fill in areas with COPCs concentrations that exceed ARARs or presenting unacceptable human health or ecological risks, is a contaminated medium addressed by remedial alternatives (Section 5.2).

Soil/fill on Lot 64 where NAPL (residual petroleum waste) was observed is a contaminated medium addressed in Section 5.1. Per RAOs (Section 3.6), the potential off-site movement of soil/fill is a pathway to be addressed in Section 5.2.

Surface soil/fill on Lots 67 and 69, which pose potential ecological risks, is a medium to be addressed in the FS. Ecological COPECs are listed in Section 2.8.

3.5.3 Groundwater

As stated in the RIR, groundwater is not currently used for potable water and is not reasonably expected to be used as a potable source in the future. However, the aquifer underlying the Site is classified by NJDEP as Class IIA, regardless of whether the groundwater is currently being used as a potable source. Hypothetical future potable use of groundwater is presented in the BHHRA for the purpose of ensuring that the FS includes one or more alternatives that are protective of this exposure pathway. Based on the hypothetical future potable use, the COPCs listed in Table 3-1 result in groundwater being a medium addressed in FS alternatives.

COPCs were also identified based on comparison of detected concentrations to applicable groundwater ARARs (Table 3-6). As presented in Section 3.4.2, COPCs implicate groundwater as a medium of interest. Many of these COPCs are the same chemicals as listed above for hypothetical future potable use (Table 3-1). Potential groundwater response actions are addressed in Section 5.3.

3.5.4 Soil Gas

COPCs in soil/fill presenting unacceptable risks/hazards for future indoor workers due to potential indoor vapor intrusion on Lots 58, 62, and 68, as predicted in the BHHRA, is addressed in Section 5.5. The results of additional evaluation of soil/fill with respect to soil gas consideration is presented in Section 5.5. The NJDEP Vapor Intrusion Technical Guidance (VIT) found at https://www.state.nj.us/dep/srp/guidance/vaporintrusion/ is a TBC for soil gas and vapor intrusion. This guidance also addresses potential risks/hazards to vapor intrusion for any building within 100 feet of a monitoring well where exceedances are reported.

3.5.5 Sewer Water

The Manhole 8 sewer water along with solids (Section 3.5.1) are media addressed in Section 5.4. The Lot 57 sewer wall pipe and shallow groundwater (MW-118) contained COPCs (acetone) above ARAR. The remediation of Lot 57 is being conducted under NJDEP via a Licensed Site Remediation Professional (LSRP) outside of the FS. The NJDEP-assigned case number via the NJDEP Hotline is 20-04-05-0923-04.

The remediation activities are being conducted by the person responsible for remediation (Lot 57 owner/operator). LSRP is to communicate and work with USEPA on Lot 57 remedial action. USEPA, through NJDEP, is to approve of any work.

3.6 Remedial Action Objectives and General Response Actions

Medium-specific RAOs have been developed to mitigate potential on-site health risks, and corresponding GRAs have been identified that could potentially satisfy the RAOs. The medium-specific RAOs focus on the specific areas and regulated substances to which exceedances of USEPA's target risk criteria are attributed.

In accordance with CERCLA guidance (Land Use in the CERCLA Remedy Selection Process, OSWER Directive No. 9355.7-04), RAOs and remedial alternatives should be developed to achieve cleanup levels that are consistent with the reasonable anticipated future land use over as much of the Site as possible. Because the Site is located within a dedicated industrial zone where residential use is prohibited and current owners and operators have expressed no intent in changing use, land use is expected to remain non-residential for the foreseeable future. Accordingly, RAOs and GRAs have been drafted using the results of the RIR, BHHRA, and SLERA to address those media posing risk to human health, welfare, or the environment that are consistent with anticipated future site use for non-residential purposes. A deed recording prohibiting such residential use would need to be implemented to enforce use restrictions.

Results of the SLERA indicate that risks to ecological site receptors that exceed screening thresholds will be addressed via remedial actions designed to protect risks to human health. Additionally, there are two lots (67 and 69) that will require consideration of remedial actions to address risks specific to ecological receptors from surface soil/fill. RAOs and GRAs for each medium of interest are summarized below.

REMEDIAL ACTION OBJECTIVES AND GENERAL RESPONSE ACTIONS

Media of Interest	RAO	GRA
Wastes	Secure or remove wastes to the extent practicable to prevent human and ecological exposures.	No Action Removal Disposal
	Prevent uncontrolled movement of wastes (i.e., spills and free-phase liquid) to environmental media.	
	Minimize or eliminate human and ecological exposure to waste materials.	
Soil/Fill	Remove or minimize COPC concentrations and eliminate human exposure pathways to COPCs in soil/fill material.	No action Institutional controls/ access restrictions Engineering controls Treatment Removal Disposal
	Remove or minimize COPEC concentrations and eliminate or minimize ecological exposure pathways to COPECs in surface soil/fill material.	
	Prevent or minimize off-site transport of soil/fill containing COPCs to minimize the potential for interaction between the Site and the Passaic River.	
	Prevent or minimize potential for leaching of COPCs to groundwater and surface water from soil/fill.	
Groundwater	Minimize contaminant concentrations and restore groundwater quality.	No action Institutional controls/use restrictions Engineering controls Removal Treatment MNA Disposal
	Prevent exposure to COPCs in groundwater.	
	Prevent or minimize migration of groundwater containing COPCs.	
	Prevent or minimize discharge of groundwater containing COPCs to surface water to minimize the potential for interaction between the Site and the Passaic River.	
Soil Gas	Minimize contaminant levels in sources of COPCs in soil gas that may migrate to indoor air of overlying buildings.	No action Institutional controls Engineering controls Removal Treatment (if necessary)

Media of Interest	RAO	GRA
Sewer Water	Prevent exposure to COPCs in sewer water and solids associated with a release from the inactive sewer system.	No action Removal Disposal
	Minimize concentrations of COPCs in sewer water (inactive system).	
	Prevent or minimize discharge of sewer water COPCs to surface water to minimize the potential for interaction between the Site and the Passaic River.	

3.7 Preliminary Remediation Goals

PRGs are chemical-specific, quantitative goals for each medium and/or exposure route that are intended to be protective of human health and the environment and meet RAOs. PRGs were developed based on ARARs and risk-based levels (human health and ecological), with consideration of current and reasonably anticipated future use, background concentrations, analytical detection limits, guidance values, and other available information to aid in defining the extent of contaminated media and enable remedial action cost estimation. PRGs consider TBCs in the absence of ARARs. During the remedial design, future land use assumptions used in developing PRGs will be confirmed. As noted previously, the Site has a lengthy industrial history, and is zoned for industrial non-residential purposes, which is consistent with findings of the reuse assessment conducted in the RI.

PRGs for soil/fill, soil gas, and groundwater are discussed in the subsections below. No PRGs have been assigned for sewer water and waste; however, soil/fill impacted by NAPL will be evaluated and compared to NJDEP EPH ARAR. Wastes remaining on Site and sewer water will be addressed through removal, followed by reduction of toxicity, mobility, or volume (TMV). If wastes are determined to be characteristically hazardous, the Resource Conservation and Recovery Act (RCRA) Land Disposal Restriction (LDR) will be an ARAR.

3.7.1 Preliminary Remediation Goals for Soil/Fill

As described in the BHHRA and RIR, the COPC, human receptors and media with unacceptable risks/hazards are as follows:

Receptor	COPC	Medium	Exposure Routes
Child visitor	Lead, copper	Soil/fill	Dermal contact, incidental ingestion, dust inhalation
Trespasser	Lead	Soil/fill	Dermal contact, incidental ingestion, dust inhalation
Construction worker	Lead	Soil/fill	Dermal contact, incidental ingestion, dust inhalation
Utility worker	Lead	Soil/fill	Dermal contact, incidental ingestion, dust inhalation
Outdoor worker	Lead	Soil/fill	Dermal contact, incidental ingestion, dust inhalation

Receptor	COPC	Medium	Exposure Routes
Indoor worker	Lead	Soil/fill	Dermal contact, incidental ingestion, dust inhalation
	TCE, xylenes, naphthalene	Soil/fill	Inhalation of indoor air (vapor intrusion)

Soil/fill PRGs were developed for these risk drivers and then used in conjunction with the ARAR comparisons to identify areas of the Site requiring remedial actions and to support estimations of areas and/or volumes of impacted media. The general PRG selection process is based on USEPA (1991b) guidance and is as follows:

Step 1: Calculate risk-based concentrations (RBCs) for human health and ecological receptors. Human health RBCs (see Step 1a) are derived for each risk driver/receptor scenario identified as posing risk/hazard in excess of USEPA unacceptable levels in the BHHRA, for both cancer and non-cancer-based effects, as applicable. Cancer risk-based RBCs are calculated for the 10^{-6}, 10^{-5} and 10^{-4} cancer risk levels and/or for a non-cancer protection goal of a HI = 1, as appropriate for the COPC. The selected RBCs are the lower of the cancer risk- and non-cancer hazard-based values provided they are within the USEPA NCP risk range. The point of departure is the cancer risk of 1×10^{-6}. Ecological RBCs (Step 1b) are based on screening criteria as described further below.

Step 2: Identify any numeric ARARs or TBCs.

Step 3: Identify a background concentration, if available. PRGs should not be set at a level that is lower than expected background concentrations.

Step 4: Identify a laboratory reporting limit deemed reasonably achievable for the COPC and medium in question; PRGs should not be set at a level that is technically unachievable in the laboratory.

Step 5: Selection of final PRGs.

RBCs, ARARs/TBCs, laboratory reporting limits, and background concentrations are then all considered in conjunction with other site-specific information when selecting the PRG. Each step of this process is described in further detail below.

Step 1a: Calculation of the RBCs for Human Health

Direct Contact with Soil/Fill: Copper and Lead

Copper

A non-cancer soil/fill RBC for copper, based on direct contact exposure routes, was developed for the child visitor scenario. Because no cancer-based toxicity values are available for copper (which is classified by USEPA as Class D, not classifiable as to human carcinogenicity, USEPA, 2020), a cancer-based RBC was not calculated.

The non-cancer RBC was derived based on the exposure assumptions and toxicity values specified in the BHHRA. The soil/fill RBC accounts for multiple exposure routes, including incidental ingestion of and dermal contact with copper in soil/fill, and inhalation of copper entrained on fugitive dust particles. However, because USEPA currently does not provide a dermal absorption fraction (ABSd) in soil and no inhalation reference concentration (RfC) was identified for copper, complete information is not available to calculate RBCs for either the dermal contact or dust inhalation route, an RBC was calculated for only the incidental ingestion route of exposure. Thus, the soil/fill RBC for copper is based only on incidental ingestion. A reference dose (RfD) of 0.001 mg/kg per day was used to calculate the incidental ingestion RBC. This RfD was derived by dividing the Agency for Toxic Substances and Disease Registry (ATSDR) intermediate minimal risk level by an uncertainty factor of 10, per USEPA Region 2 (Ramboll, 2020a).[1] The copper RBC is based on a target HI = 1, in accordance with USEPA NCP guidance (USEPA, 1991b).

Table 3-7 presents the equations and input parameters for the child visitor scenario, for which a soil direct contact RBC of 526 mg/kg was derived.

Lead

Health risks associated with exposure to lead in soil/fill are evaluated using an approach different from that of other types of contaminants. For lead, biokinetic uptake models are used to estimate a theoretical probability that the blood lead (PbB) level will exceed a target PbB level. Lead hazards were evaluated in the BHHRA exposure scenarios. Lead risks for young children (6 and under, such as the child visitor) were evaluated using the USEPA Integrated Exposure Uptake Biokinetic Model for Children (IEUBK), whereas older receptors were evaluated using the USEPA Adult Lead Methodology (ALM).

The IEUBK model is applicable for the child visitor scenario. The BHHRA indicated that, using the IEUBK: "the USEPA Region 2 soil screening level of 200 mg/kg based on evaluation of the 12 to 72-month age range [USEPA, 2017] corresponds to a blood lead distribution that does not exceed 5 µg/dL for 5% of the population" (BHHRA; Section 4.5.4). However, this soil concentration represents the entire daily dose of soil at a residence. The BHHRA noted various uncertainties that could potentially over- or underestimate health hazards associated with the child visitor scenario (see Section 6.3.3 of BHHRA), that includes routine exposures to both interior (vapor intrusion) and exterior (soil/fill contact and ingestion) site COPCs and which is an unlikely scenario given that the Site is an industrial property. As noted, future residential use of the Site is not planned, will be restricted, and is not considered in development of RAOs.

The BHHRA assumed that 1/7th of the daily dose of soil/fill would occur at the Site, while the remainder of the daily dose (6/7th) would occur at the home at an average soil lead level for urban piedmont in New Jersey of 139 mg/kg (BHHRA Section 4.5.6). Adjusting the 200 mg/kg soil screening value for time spent at the Site results in a lead RBC for the child visitor of 567 mg/kg.[2] Therefore, an RBC of 567 mg/kg was selected as the child visitor RBC for lead.

The lead RBCs for other receptor scenarios, including the indoor worker, outdoor worker, utility worker, and construction worker, were derived using the ALM. (According to the BHHRA, the adolescent trespasser lead exposure was qualitatively assessed using the outdoor worker scenario; therefore, the outdoor worker RBC is assumed protective of the adolescent trespasser.) All input parameters for the ALM for each scenario are the same as those used in the BHHRA and include both USEPA default values and site-specific values. Tables 3-8 through 3-11 provide the ALM input values and calculation of RBCs.

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[1] Note that the RfD used as the basis of the NJDEP soil remediation standard (ARARs for the Site) is based on an oral RfD of 0.04 mg/kg per day, referenced to the USEPA Health Effects Assessment Summary Tables (1997), which partially accounts for the large discrepancy in concentration between the ARAR and RBC.

[2] Verification of lead visitor cleanup number is as follows:

(6/7 * 139 mg/kg [background level]) + (1/7 * 567 [site RBC] mg/kg) = 200 mg/kg (IEUBK-based cleanup number).

Soil RBCs protective of direct contact exposures for lead are summarized below.

Receptor	Lead Soil RBC – direct contact (mg/kg)
Child Visitor	567
Indoor Worker	1,050
Outdoor Worker	784
Utility Worker	3,292
Construction Worker	441

Vapor Intrusion of VOCs via Subsurface Soil

Cancer risk exceeding the upper end of the USEPA NCP risk range and/or a non-cancer HI exceeding USEPA goal of protection of 1 was identified for an indoor worker exposed to TCE, naphthalene and total xylenes via vapor intrusion from soil. Both cancer risk-based and non-cancer hazard-based soil RBCs were thus developed for these COPCs. The cancer-risk RBC is based on a target cancer risk of one in one million (1E-06), which is the lower end of the USEPA NCP risk range. The non-cancer-based RBC is based on a HI = 1.

To calculate a soil RBC protective of the vapor intrusion pathway, a target indoor air concentration was first derived. This indoor air concentration (IA) was calculated using the equations and input parameters provided in Table 3-12. Exposure assumptions and toxicity values used in the derivation of this indoor air concentration are the same as those used in the BHHRA for the indoor worker scenario (Ramboll, 2020a).

This target indoor air concentration was then divided by an attenuation factor, alpha (α), which accounts for the attenuation of VOCs between subsurface soil gas and indoor air of a theoretical building. Alpha values for the COPCs were obtained from the BHHRA (BHHRA, Appendix D). The resulting quotient (IA / α) is the target soil gas concentration (Csg). The soil RBC was then back-calculated from Csg using chemical-specific characteristics (Henry's Law soil and organic carbon-water partition coefficients) in conjunction with soil characteristics specific to sand (organic carbon content, effective air-filled and water-filled porosity and bulk density values) and chemical characteristics. Equations and input values for calculation of IA, Csg and RBC are provided in Table 3-12.

The lowest value between the cancer-based RBC based on 1.0E-06 and the non-cancer hazard-based RBC was selected as the final soil/fill RBC protective of the vapor intrusion pathway. The resulting soil/fill RBCs for the COPCs are summarized below.

COPC	RBC – vapor intrusion (mg/kg)
TCE	0.02
Total Xylenes	6.5
Naphthalene	0.62

These RBCs were calculated using attenuation factors for soil vapor intrusion (see Appendix D of the BHHRA) assuming an infinite source and are applicable for the determination of appropriate response actions (e.g., vapor barriers or vapor mitigation systems). The soil vapor intrusion evaluation in the BHHRA included a mass balance check that is not incorporated into these RBCs.

Step 1B: Calculation of the RBCs for Ecological Receptors.

An ecological RBC was identified for any COPEC in the Ramboll April 2020 SLERA that had a HQ greater than 1 at Lots 67 and 69, the only lots where ecological risk is the sole driver for remediation. RBCs for these COPECs consist of the New Jersey ecological screening values (ESVs) used in the SLERA. These values are shown in Table 3-13.

Step 2: Identification of ARARs/TBCs

The Site is an industrial property and is zoned for non-residential use. Future residential use is not expected to occur, and existing and additional land use restrictions will continue industrial or commercial uses of the Site and prohibit redevelopment for residential use. In light of this, Step 2 of the PRG evaluation focused on non-residential ARARs. PRGs consider TBC in the absence of ARARs.

ARARs applicable to non-residential use of soil include the NJDEP NRDCSRS (N.J.A.C. 7:26D-4.3). These ARARs are summarized in Table 3-13. NJDEP "Guidance Document for Development of Impact to Groundwater Soil Remediation Standards" is a soil TBC and also listed in Table 3-13 for completeness; however, site-specific IGWSSLs were not developed for a soil/fill comparison because ARARs were available for comparison and determine exceedance. ARARs should be reviewed during the remedial design to reflect the most recent promulgated standards.

These soil/fill ARARs are compared to the RBC when selecting the final PRG (see Step 5 below).

Step 3: Identification of Background Concentrations

Site-specific background concentrations are not available. The background concentrations for volatile organic COPCs (TCE, xylenes) are expected to be below detection limits. While naphthalene could be attributed to off-site anthropogenic sources (such as fuel emissions), it was assumed that the background concentration for this COPC is below detection limits absent any data specific to the Site.

Both copper and lead may be present in soil/fill due to natural underlying geochemistry and/or non-point anthropogenic sources such as cinders, ash, and fill materials. Because the soil/fill is non-native material placed at the Site over a 20-year period, there is likely more than one soil/fill source. As described in the RIR, the fill is classified as historical fill in accordance with NJDEP regulations; however, the historic fill may also have been impacted due to historical and/or current operations and recent and illegal disposal. Representative values for historic fill were factored into the selection of all PRGs in lieu of background data. These values were drawn from Table 4-2 in the 2009 N.J.A.C. 7:26E Technical Requirements for Site Remediation and are shown in Table 3-13. These values provide a point of comparison to ensure that final PRGs are not lower than background levels; however, it should be noted that the historic fill values have been withdrawn from NJDEP and are being presented here as a possible point of comparison.

Step 4: Identification of Laboratory Reporting Limits

RBCs and ARARs for copper and lead are at levels reasonably expected to be achieved via laboratory analysis. The ranges of laboratory reporting limits for other COPCs, as reported in the BHHRA (Table 2.01 of Appendix A) are as follows:

COPC	Range of Laboratory Reporting Limits (mg/kg)
Copper	(all detected)
Lead	(all detected)
TCE	0.00027 – 0.081
Total Xylenes	0.00057 – 0.00092
Naphthalene	0.011 – 0.056

The reporting limits achievable for site soils/fill are lower than any of the RBCs or ARARs identified in Steps 1-2 above. Therefore, laboratory reporting limits were not considered further in development of PRGs.

Step 5: Selection of Final PRGs

Based on consideration of criteria described in Steps 1 through 4 above, PRGs were identified for each COPC.

Human health-based PRGs are applicable across the entire Site. The human health PRGs were selected as follows:

- Comparison of the non-cancer hazard-based RBC and the cancer risk-based RBCs at multiple cancer risk levels (10^{-6} through 10^{-4}) and selection of a ‘final’ RBC; and
- Comparison of this ‘final’ RBC to the ARAR.

Note that RBCs were calculated for only the risk drivers identified in the BHHRA. Constituents that were not identified as risk drivers in the BHHRA but had concentrations exceeding ARARs were retained as COPCs. The PRG for each of these contaminants is the ARAR.

Ecological PRGs will be used exclusively for the two undeveloped lots (67 and 69) because no ARAR exceedances or human health risks were identified for these two lots. For other properties where ecological risk was also identified and/or on a site-wide basis, remedial alternatives and selected cleanup values will be evaluated to ensure the proposed remedial alternatives will address the COPECs associated with HQs greater than 1 in surface soil/fill and that the remediation goals are protective of ecological receptors.

The selected PRGs are discussed below.

Human Health PRGs

For **lead**, RBCs range from 441 mg/kg to 3,292 mg/kg, based on the ALM for adult receptors and the IEUBK Model for the child visitor receptor; the ARAR for lead is 800 mg/kg, and the representative historic fill average value is 574 mg/kg. Of these values, a risk management decision was made to select the ARAR of 800 mg/kg as the PRG for lead. This concentration is similar to the RBC for the outdoor worker and adequately protective of both the indoor worker and utility worker receptors. While lower RBCs were derived for the child visitor and construction worker scenarios, these values were not selected as PRGs because: 1) the child visitor scenario, that assumed both indoor and outdoor, routine exposures to a young child, is an uncertain scenario for an industrial property that is now and likely in the future to be largely paved/covered and because the higher intensity soil/fill exposures assumed for this young receptor[3] are anticipated to be more limited if the child is accompanied by an adult; and 2) while a construction worker scenario is plausible considering the potential for redevelopment of the Site, exposures to lead during any future excavation work will need to be recognized and managed appropriately in the selected remedial alternative.

For **copper**, the RBC of 526 mg/kg is substantially lower than the ARAR of 45,000 mg/kg. As discussed, the child visitor scenario is an uncertain, conservative scenario. The RfD is the ATSDR subchronic Minimal Risk Level divided by a factor of 10 to represent a chronic exposure. High intensity outdoor soil/fill exposures is uncertain based on the industrial zoning of the Site. The BHHRA identified a HI greater than 1 for the child visitor scenario at only Lot 63; it is noted that the EPC for copper at this lot is driven primarily by one sample location (B-33), which is also co-located with an elevated lead concentration that exceeds the lead PRG, and thus, is already being addressed in the FS. However, use of the ARAR as a cleanup objective may not be adequately protective of other non-residential receptors if health

[3] The assumptions are a young child (6 years and younger) exposed 52 days/year (1 day per week) for 2 hours/day.

risk is based on the oral RfD used in the BHHRA, given the 40-fold difference in toxicity values between those used to derive the ARAR (0.04 mg/kg/day) and the RBC (0.001 mg/kg/day). Thus, the RBC of 526 mg/kg is conservatively selected as the PRG for copper.

The RBCs for **TCE, total xylenes and naphthalene** are based on the vapor intrusion pathway, whereas the ARARs are based on the direct contact pathway. The BHHRA did not indicate unacceptable cancer risks/hazards for these COPCs based on direct contact. Because the ARARs would not be protective of the vapor intrusion pathway, the RBCs for TCE, total xylenes, and naphthalene are selected as the PRGs, as follows:

- Xylenes – the RBC is based on a non-cancer HI = 1 since no cancer toxicity value is available for this compound.
- TCE and Naphthalene – the RBCs based on a 1 x 10^{-6} cancer risk was compared to the non-cancer hazard-based RBC, and the lower of the two values was selected. TCE and naphthalene are the only two carcinogenic risk drivers identified in the BHHRA; all other carcinogenic COPCs are presumed to have *de minimis* associated risks, and cumulative risk associated with these RBCs is not expected to exceed the upper end of the USEPA NCP risk range.

COPCs that have unacceptable risks/hazards and/or exceed ARARs are identified as COCs and will be the focus of the remedial alternatives presented (refer to Table 3-5A and Table 3-5B for soil exceedances and Table 3-5C and Table 3-5D for soil gas exceedances). The footprint of the remedial alternatives is based on a single-point compliance to the PRG, regardless of lot boundary, and may extend beyond the lot boundaries identified in the BHHRA (refer to figures presented in Appendix A). The delineation of the area will be confirmed during the remedial design. PRGs for COCs associated with unacceptable risks/hazards listed in the RIR and BHHRA and that are site related (associated with past or current operations) are summarized in the table below.

Chemical of Concern	Selected PRG (mg/kg)	Basis of PRG	Reference Figure on Exceedances	Remedial Footprint Figure in Appendix A
Lead	800	ARAR/ALM-outdoor worker	3-7	A-3
Copper	526	Non-cancer – child visitor	3-35	A-2
Naphthalene*	0.62	Cancer – vapor intrusion, worker*	3-36	A-13
TCE	0.02	Non-cancer – vapor intrusion, worker	3-37	A-14
Total Xylenes	6.5	Non-cancer – vapor intrusion, worker	3-38	A-15

* The soil/fill PRG for naphthalene of 0.62 mg/kg is for soil/fill, but it is protective of vapor intrusion (soil gas) for workers. A separate naphthalene PRG (associated with ARAR exceedance in soil/fill) of 17 mg/kg is discussed below. Where the remedial footprint for soil gas and soil/fill overlap, the more conservative PRG would apply.

Table 3-13 presents the selection of PRGs for human health soil/fill COPCs. The PRGs selected for the BHHRA risk drivers were evaluated to determine if they would result in cumulative cancer risks or non-cancer hazards exceeding the acceptable USEPA NCP risk range of 10^{-4} to 10^{-6} and the non-cancer hazard goal of protection of a HI = 1. Incremental lifetime cancer risks and non-cancer HIs associated with the above PRGs are presented in Table 3-14. As shown in Table 3-14, the cumulative cancer risk for the future indoor worker is 2E-06, which is within the acceptable USEPA NCP risk range. The total HI for the future indoor worker is 1.4. A target organ analysis was conducted for the future indoor worker, as shown in Table 3-14. Based on the target organ analysis, naphthalene and xylenes have a common target organ, the nervous system, which results in a target organ HI of 1. Other target organs His are 0.4 for

TCE/immune system, development, cardiovascular system and 0.03 for naphthalene/respiratory system. Based on the target organ analysis, the HI for the primary target organs are at or below 1, the USEPA non-cancer protection goal. The selected remedial alternative needs to recognize that the PRG for lead (800 mg/kg) may not be protective of a future construction worker scenario and needs to manage this potential hazard appropriately.

ARAR Exceedances

As discussed, the ARAR was selected as the soil/fill PRG for constituents with ARAR exceedances but not identified as risk drivers in the BHHRA (refer to Table 3-5A and Table 3-5B for soil exceedances). COPCs with such exceedance are identified as COCs and will also be addressed in the remedial alternatives. The footprint of the remedial alternatives is based on a single-point compliance to the ARAR, regardless of lot boundary (refer to figures presented in Appendix A). The delineation of the area and depth of contamination will be confirmed during the remedial design. PRGs for soil/fill COCs that exceed ARARs and that are site related (associated with past or current operations) are summarized in the table below.

COPC	PRG based on ARAR (mg/kg)	ARAR Exceedance Figure	Remedial Footprint Figure in Appendix A
Arsenic	19	3-1	A-1
Benzo(a)anthracene	17	3-3	A-4
Benzo(a)pyrene	2	3-4	A-5
Benzo(b)fluoranthene	17	3-5	A-6
Dibenz(a,h)anthracene	2	3-6	A-7
Total PCBs	1	3-10	A-8
Benzene	5	3-2	A-9
Naphthalene (soil ARAR, not related to soil gas)*	17	3-9	A-10
Vinyl Chloride	2	3-14	A-11

* The soil/fill PRG for naphthalene of 17 mg/kg is associated with an ARAR exceedance in soil/fill. A separate naphthalene PRG (associated with soil/fill to be protective of the vapor intrusion for workers) of 0.62 mg/kg is discussed above. Where the remedial footprint for soil gas and soil/fill overlap, the more conservative PRG would apply.

No PRGs were assigned to the iron and manganese ARAR exceedances in soil/fill because these metals are naturally occurring in soil. No PRGs were assigned for EPH; however, soil/fill impacted by NAPL will be compared to NJDEP EPH ARARs and delineated per the NJDEP guidance.

In developing the PRGs, a number of assumptions regarding the future land use and zoning were used (Section 2.9). These assumptions should be confirmed during final remedial design.

Ecological PRGs

The SLERA did not account for existing surface barriers (buildings, pavement) over most of the Site. These barriers eliminate potential ecological risks at these locations. Lots 67 and 69, located at the southern and northern ends of the Site, respectively, both have one or more shallow soil/fill samples with concentrations of select COPECs exceeding ESCs but neither lot has concentrations that exceed either ARARs or human-health risk-based values. Lots 67 and 69 are unpaved except for two buildings located on Lot 69. Remedial decisions for these areas considered ecological receptors hypothetically present in either the undeveloped portion of these lots or adjacent ecological habitat, which typically consists of vegetated margins around paved areas. These areas, like others in the site-wide SLERA, were evaluated by comparing shallow sample results to screening values for birds, mammals, plants, and soil invertebrates. Constituents exceeding screening values consisted primarily of PAHs and some metals and are listed in Table 3-13.

For PAHs, the lowest of available ESV, 1.1 mg/kg of total high-molecular-weight PAHs based on the protection of small mammals, was used to evaluate soil/fill data from samples collected both within the vegetated areas (designated as "ecological habitat") and adjacent to these areas. However, this PAH value is unrepresentative of actual risks from PAHs at the Site. The mammal ESV is a USEPA ecological soil screening level based solely on the toxicity of benzo(a)pyrene, considered the most toxic of the PAHs; however, Lot 67 and Lot 69 samples contain a greater proportion of less toxic high- and low-molecular weight PAHs. In addition, the unusually low ESV of 1.1 mg/kg is below the average concentration of total PAHs (1.8 mg/kg) detected in NJDEP surface soil sampling of relatively unimpacted areas in Newark and elsewhere in Essex County (NJDEP, 2020; Appendix 3). The potential on-site risk from PAHs at Lots 67 and 69 is thus likely to be less than suggested by the use of the ESV.

Regardless of the screening levels, the potential ecological risk from these lots is reduced due to the low value of the habitat generally, particularly for wildlife receptors. A review of the environment represented by samples identified as collected from "ecological habitat" (B-53 in Lot 67 and B-63 and DF-7 in Lot 69) indicates that these areas are comprised of vegetation around the edges of pavement or other developed parts of the lots. Vegetated areas are small and highly fragmented, separated by open areas of pavement where small mammals would be exposed to predation by raptors and other predators. Vegetation consists largely of invasive species, which typically provide less suitable forage material for herbivores, and the small size of the areas would provide a limited prey base for invertebrate-eating carnivores such as the robin or shrew. For these reasons, Lot 67 and Lot 69 areas are unlikely to provide the habitat necessary for a sustaining population of small mammals or birds, though both may forage in the area at times.

Nonetheless, both Lots 67 and 69 will be considered for remediation with the objective of reducing the exposure of ecological receptors in shallow soil/fill to constituent concentrations above the ecological screening values. No further risk assessment is proposed. COPECs identified in Section 2.8 would be evaluated in the FS as Chemicals of Ecological Concern (COEC).

3.7.2 Preliminary Remediation Goals for Groundwater

Groundwater is not currently used as a source of potable water, and future groundwater use at the Site is unlikely because site-specific conductivity readings of the shallow groundwater indicate brackish conditions due to tidal influence of the adjacent Passaic River. Additionally, the Site and surrounding area are served by the City of Newark's potable water system. Potable use of groundwater should be avoided to prevent potential mobilization of the soluble fraction of COPCs in fill that has been identified at the Site.

For drinking water use, NJDEP GWQS are chemical-specific ARARs. Based on the default groundwater categorization, NJDEP and USEPA drinking water standards are also relevant and appropriate requirements. For on-site contaminants, NJDEP GWQS are the most stringent promulgated standards and were used as the PRGs.

Groundwater in some wells contains contamination above ARARs (Section 3.4.2). COPCs that exceed ARARs, as described in Section 3.4.2, are identified as COCs and are the focus of the remedial alternatives. PRGs for groundwater COCs that exceed ARARs and that are site related (associated with past or current operations) are summarized in the table below:

Parameter	Chemical Class	PRG based on ARAR (µg/L)
Lead	Metal	5
Acetone	VOC	6,000
Cresol, p-	SVOC	50
Bis(2-ethylhexyl)phthalate	SVOC	3
Benzene	VOC	1
Ethylbenzene	VOC	700
Toluene	VOC	600
Total Xylene	VOC	1,000
Methylene chloride	VOC	3
Tetrachloroethylene	VOC	1
Trichloroethylene	VOC	1
Vinyl chloride	VOC	1
1,4-Dioxane	SVOC	0.4
2- Methylnapthalene,	SVOC	30
Benzo(a)anthracene	SVOC	0.1
Benzo(b)fluoranthene	SVOC	0.1
Benzo(a)pyrene	SVOC	0.1
Indeno(1,2,3-cd)pyrene	SVOC	0.2

PRG was not assigned for 1,1,2-Trichloroethane in groundwater but will be evaluated during the remedial design. 1,1,2-Trichloroethane concentrations exceed ARARs in multiple monitoring wells on Lot 63 and Lot 64 (refer to Figure 3-15 for shallow monitoring wells and Figure 3-32 for deep monitoring wells). 1,1,2-Trichloroethane was detected in shallow groundwater monitoring wells surrounding the USTs, but not detected in the UST contents possibly due to elevated reporting limits. It should be noted while the presence of 1,1,2-trichloroethane could not be confirmed in the USTs, the elevated reporting limits for 1,1,2-Trichloroethane were above the ARAR of 3 ug/L in six of the seven tanks. The presence of 1,1,2-trichloroethane will be confirmed during the remedial design in the USTs and shallow groundwater monitoring wells to verify if 1,1,2-trichloroethane is a site-related groundwater contaminant associated with the USTs. As required, a site-related PRG will be assigned.

Benzo(a)pyrene (2 shallow fill unit monitoring wells) , benzo(a)anthracene (4 shallow fill unit monitoring wells), indeno(1,2,3-cd)pyrene (2 shallow fill unit monitoring wells), and benzo(b)fluoranthene (3 shallow fill unit monitoring wells) concentrations exceed ARARs in shallow fill unit monitoring wells (refer to Figure 3-21, 3-23, and 3-25 and Table 3-6). These PAHs were detected at levels exceeding ARARs during at least one groundwater sampling event in MW-108, which is downgradient of the NAPL-impacted soils on Lot 64. MW-108 and MW-106 are near the USTs and NAPL-impacted soils, and they contain BTEX (levels ranging from 5,200 u/L in MW-106 to 44 ug/L in MW-108), which can be indicative of petroleum-impacted groundwater. Because of these reported groundwater exceedances in MW-108 and other wells, a PRG has been assigned to these four PAH compounds. It should be noted that while PAHs were detected in MW-108, they were reported as non-detected concentrations in MW-106 possibly due to laboratory dilutions resulting in elevated reporting limits above their ARARs. Likewise on Lot 58, benzo(a)anthracene, indeno(1,2,3-cd)pyrene, and benzo(b)fluoranthene were detected at concentrations that exceed ARARs in MW-124.

This monitoring well contains BTEX (equal to 39,700 ug/L), which can be indicative of petroleum-impacted groundwater. Benzo(a)pyrene, however, was reported as non-detected in MW-124 due to laboratory dilutions with an elevated detection limit, and therefore, its presence could not be confirmed in MW-124. During the remedial design, the presence of benzo(a)pyrene, benzo(a)anthracene, indeno(1,2,3-cd)pyrene, and benzo(b)fluoranthene on Lots 63, 64, and 58 will be verified since laboratory dilutions resulted in elevated reporting limits and nondetected PAH concentrations reported in some wells.

No PRGs were assigned to the following ARAR exceedances in groundwater because these constituents are naturally occurring in groundwater that is tidally impacted, not a significant source, or do not appear to be associated with known on-site activities:

- Aluminum: Naturally occurring in groundwater
- Antimony: Mostly non-detected with four exceedances (MW-105, MW-101, MW-103, and MW-120) that are 1x to 3x ARAR
- Arsenic: Mostly low-level detections; site-wide contaminant in shallow and deep groundwater
- Barium: Mostly low-level detections with one exceedance (MW-116) that is 2x ARAR
- Beryllium: Mostly non-detected with three low-level detections that exceed ARARs
- Cadmium: One exceedance at MW-110
- Iron: Naturally occurring in groundwater
- Manganese: Naturally occurring in groundwater
- Methyl ethyl ketone: One exceedance at MW-117
- Selenium: Mostly low-level detections with three exceedances (MW-116, MW-106, MW-101) that are 1x to 2x ARAR
- Sodium: Naturally occurring in groundwater that is tidally influenced
- Dibromo-3-chloropropane, 1,2-: One exceedance at MW-121
- Dichloropropene, 1,3-: One exceedance at MW-122
- Hexanone, 2-: One exceedance at MW-122
- Tetrachloroethane, 1,1,2,2-: One exceedance at MW-203
- Trichlorobenzene, 1,2,4-: One exceedance at MW-122
- Pentachlorophenol: One exceedance in MW-107

4. IDENTIFICATION AND SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

4.1 Identification and Screening of Technologies

Technologies and process options were compiled for the GRA categories that could potentially satisfy RAOs for each medium of interest. Technology types are general categories of remedial technologies, while process options refer to specific processes within each remedial technology type. Representative remedial technologies and process options that are retained are used to develop remedial action alternatives in Section 5, either alone or in combination with other technologies.

Screening tables identifying remedial technology types, process options, and screening results are presented for waste, soil/fill, groundwater, soil gas, and sewer water (Tables 4-1, 4-2, 4-3, 4-4, and 4-5, respectively). Assembled process options were subjected to a preliminary technology screening to verify their applicability to Site contaminants and physical setting. The technology screening approach is based on the procedures outlined in the Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA, 1988). Potential candidate technologies were initially presented in the ICT Memorandum (Woodard & Curran, 2019a) approved by USEPA on July 17, 2019. Since that time, more recent data from the final RI and BHHRA have been used to update screening results.

The technology screening evaluation process uses three criteria: effectiveness, implementability, and relative cost. Among these three, the effectiveness criterion outweighs the implementability and relative cost criteria. These criteria are described below.

Effectiveness: This evaluation criterion focuses on the effectiveness of process options to reduce the TMV of contamination for long-term protection and to meet the RAOs and PRGs. It also evaluates the potential impacts to human health and the environment during construction and implementation and how proven and reliable the process is with respect to site-specific conditions. Technologies and process options that are not effective are eliminated using this criterion.

Implementability: This evaluation criterion encompasses both the technical and administrative feasibility of the technology or process option. It includes an evaluation of pretreatment requirements, remedial construction requirements, residuals management, the relative ease or difficulty of operation and maintenance (O&M), and the availability of qualified vendors. Technologies and process options that are clearly not implementable at the Site are eliminated using this criterion.

Relative Cost: Cost plays a limited role in the screening process. Both capital and O&M costs are considered. The cost analysis is based on engineering judgment, and each process is evaluated as to whether costs are low, medium, or high relative to the other options within the same GRA category.

4.2 Evaluation of Technologies and Selection of Representative Technologies

Following the preliminary technology screening, the GRAs, remedial technologies, and process options retained as potential components of a comprehensive site remedy for further evaluation are summarized by medium of concern below.

4.2.1 Waste

Retained GRAs for waste are no action, removal, and off-site disposal are listed below and in Table 4-1. Process options for each GRA are proven and readily implemented as wastes at the Site have been identified.

GRA	Remedial Technology	Process Options
No action	Not applicable	Not applicable
Removal	Mechanical transfer	Containerization or transport vehicle
Disposal	Disposal (off-site)	Solid waste landfill, used oil recycling, or treatment and disposal

4.2.2 Soil/Fill

Retained GRAs, remedial technologies, and process options for soil/fill are listed below and in Table 4-2:

GRA	Remedial Technology	Process Options
No action	Not applicable	Not applicable
Institutional controls/access restrictions	Land use restrictions	Deed notice
		Zoning/ordinances
	Barriers	Fencing/signs
Engineering controls	Cover systems	Single-layer cap
		Combination cap
	Vertical barriers	Shoreline revetment
		Sheet piling
		Soil berm
		Slurry Wall
Removal	Excavation	Mechanical
Treatment	In-situ treatment (biological)	Bioventing
	In-situ treatment (physical)	Soil vapor extraction (SVE)
		Air stripping and air sparging
	In-situ treatment (chemical)	Chemical oxidation
	In-situ treatment (immobilization)	Stabilization/solidification
	Ex-situ treatment (immobilization)	Stabilization/solidification
	Ex-situ treatment (thermal)	Thermal desorption
		Incineration (off-site)
	Ex-situ treatment (chemical)	Chemical oxidation
Beneficial reuse	Beneficial reuse	On-site fill
Disposal	Disposal (off-site)	Solid waste and hazardous waste landfills

Soil/fill with elevated concentrations of lead that is excavated may classify as RCRA characteristic waste (Waste Code D-008) if the leachate concentration of lead exceeds the Toxicity Characteristics Leaching Procedure (TCLP) regulatory limit of 5 mg/L. As a result, off-site disposal would need to comply with RCRA LDR requirements via treatment to eliminate the RCRA characteristic or alternative LDR treatment standards under 40 CFR 268.49 (Phase IV LDR). The alternative LDR treatment standards state that a hazardous waste must be treated for underlying hazardous constituents (UHCs) if concentrations are present above 10 times the universal treatment standards (UTS). The treatment must achieve a 90 percent reduction in the UHC concentration or achieve concentrations less than 10 times the UTS. For this Site, TCLP data are not available. However, using the "Rule of 20"[4] approach, it is expected that most of the lead-contaminated soil/fill will be hazardous and will require treatment because 95 percent of the RI borings had soil/fill lead concentrations greater than 100 mg/kg (88 borings out of 93) and 94 percent of the RI borings had soil/fill lead concentrations greater than 150 ppm (87 borings out of 93).

Lead-contaminated soil/fill identified for potential response actions, including some that may classify as characteristic waste, may be co-located with PCBs (Lot 70). The Toxic Substances Control Act (TSCA) provides the Federal PCB remediation policy. Excavated soil/fill containing PCBs would classify as bulk remediation waste. Bulk PCB remediation wastes at concentrations of less than 50 ppm may be disposed of at an approved PCB disposal facility; or when disposed pursuant to Section 761.61(a) or (c), a permitted municipal solid waste or non-municipal non-hazardous waste facility; or a RCRA Section 3004 or Section 3006 permitted hazardous waste landfill. Bulk PCB remediation waste at concentrations of 50 ppm or greater must be disposed of in a RCRA Section 3004 or 3006 permitted hazardous waste landfill or an approved PCB disposal facility (e.g., incinerator, chemical waste landfill) via an approved alternate disposal method (USEPA, 2005). Total PCB concentrations above 50 ppm have not been encountered at the Site, but if reported during the pre-design investigation, appropriate actions will be taken. TSCA is an action-specific ARAR.

Under NJDEP SRP policy, soils with PCB concentrations above 0.2 ppm require a deed notice and, when above 1 ppm, require a deed notice and cap. NJDEP policy allows for contaminants with appropriate institutional and engineering controls to be non-permanently remediated if the remedy is found to be protective of human health and the environment. NJDEP SRP policy is a TBC.

The process options retained for further consideration could be implemented on a site-wide basis or an individual lot basis. SVE is retained for possible application under buildings to mitigate vapor intrusion by treating soil/fill containing COPCs, if necessary. Given the relatively thin vadose zone, SVE, air stripping, and air sparging efficiency may be poor due to the potential for short-circuiting to the atmosphere in the absence of a cover system. New deed notices, capping, and a vertical barrier would require landowner consent to maintain these controls. Capping, vertical barrier, stabilization/solidification, and removal/disposal could be disruptive of current commercial activities.

During ebb tide and precipitation/flooding events, soil/fill may be susceptible to erosion, sloughing, and transport off-site. Surface water may infiltrate through the bulkhead and exposed shoreline due to tidal effects. When tidal current is flowing inland (i.e., flood tide) and during river flooding events, the soil/fill, along with the exposed shoreline, may be susceptible to infiltration of surface water and river sediment deposition. The existing bulkhead could be extended along the riverbank and raised higher. Vertical barriers such as sheet piling could be installed inland and either independent of or connected to the bulkhead to prevent or minimize off-site transport of soil/fill containing COCs. A barrier along the river could be implemented on an individual lot basis to enhance the barrier provided by the existing bulkhead. Berms along the river could be a component of the vertical barrier to control surface water movement. Vertical containment and flood protection measures could be coordinated with property redevelopment.

[4] The "Rule of 20" is a conservative approach that evaluates if soil may be hazardous using total/bulk concentrations. In the TCLP procedure, extraction fluid is used to dilute the soil sample at a ratio of 20:1 by weight. If <u>all</u> of a constituent in the sample completely dissolves into the extraction fluid, then the concentration in the fluid would be 20 times less than the original undiluted soil sample. This means that the TCLP limit can be multiplied by 20 to estimate a total concentration that may potentially exceed that limit. For lead, the concentration that may potentially exceed the RCRA limit is 100 mg/kg and the concentration that may potentially require treatment for lead prior to disposal is 150 mg/kg. Note that lead hazardous material may require treatment for other known UHCs if concentrations are present at 10 times the UTS.

4.2.3 Groundwater

Retained GRAs, remedial technologies, and process options for groundwater, as listed below and in Table 4-3, have been updated from the approved ICT Memorandum based on more recent groundwater data:

GRA	Remedial Technology	Process Options
No action	Not applicable	Not applicable
Institutional controls/access	Use restrictions	CEA
		Well restriction area (WRA)
Restrictions	Barriers	Fencing/signs
Engineering controls	Subsurface barriers	Sheet piling
		Slurry Wall
Removal	Collection Systems	Pumping Wells
		Subsurface Drains
Treatment	Ex-situ (physical)	Filtration
		Granular activated carbon
	Ex-situ (chemical)	Chemical oxidation
		Chemical precipitation
	In-situ (biological)	Bioremediation
		Biosparging
	In-situ (physical)	Immobilization
		Air sparging
	In-situ (chemical)	In-situ chemical oxidation
		In-situ chemical reduction
		In-situ chemical precipitation
MNA	Monitoring	Not applicable
Disposal	Disposal (off-site)	Discharge to local POTW
	Disposal (on-site)	Discharge to surface water

Groundwater use restrictions under NJDEP regulations require property owner notification but not owner permission. Relative to the three groundwater sampling events, groundwater concentrations of some COPCs were lower for the last event than prior events. This observation could simply represent expected heterogeneity in the matrix or it could possibly suggest source removal (illegal activities reduced or stopped) or natural degradation, but no studies have been conducted to affirm this assertion. Extraction via pumping would induce infiltration of surface water from the river. Furthermore, while pump and treat options may reduce TMV of COCs in the groundwater, this process option would not eliminate on-going dissolution of residual COC from the soil/fill to the groundwater that will need to be treated. Pump and treat may offer marginal improvement of groundwater quality and would have more negative environmental impact than in-situ treatment options. The options retained for further consideration could be implemented on a site-wide basis or an individual lot/area basis.

4.2.4 Soil Gas

Retained GRAs, remedial technologies, and process options for soil gas are listed below for existing buildings and future buildings and in Table 4-4. Retained GRAs, remedial technologies, and process options for soil/fill containing COCs (potential source of soil gas) are listed in Section 4.2.2 and Table 4-2 and marked with an asterisk in the embedded table below.

GRA	Remedial Technology	Process Options
No action	Not applicable	Not applicable
Institutional controls	Use restrictions	Deed notice
		CEA
	Monitoring	Indoor Air Sampling
Engineering controls	Subsurface barriers	Vapor barrier
Removal	Subsurface depressurization system (SSDS)	Active SSDS
	Excavation (*)	Mechanical (*)
Treatment	Ex-situ treatment (physical)	Immobilization/adsorption
		Photocatalytic oxidation
	Ex-situ treatment (chemical) (*)	Chemical oxidation (*)
Beneficial reuse	Beneficial reuse (*)	On-site fill (*)
Disposal	Disposal (off-site) (*)	Solid waste and hazardous waste landfills (*)
(*) Refer to Section 4.2.2. and Table 4-2 for soil/fill remedial technologies and process options		

Based on indoor air sample results, health risks/hazards posed by indoor vapors in currently occupied buildings are below USEPA acceptable levels. BHHRA results indicate that response actions may be required for future indoor workers at Lots 58, 62, and 68. As discussed in Section 5.5, response actions may also be appropriate for areas in addition to the lots identified from the BHHRA where concentrations of naphthalene, total xylenes, and TCE exceed PRGs for soil gas and may present a potential risk/hazard for future indoor workers in future occupied buildings. Retained process options are proven and readily implemented and would be implemented on an individual lot basis.

4.2.5 Sewer Water

Retained GRAs for sewer water and solids are no action and removal with off-site disposal (refer to Table 4-5). Retained process options are proven and readily implemented and would likely be implemented on a lot by lot basis, and the sewer water medium is found on Lot 1.

GRA	Remedial Technology	Process Options
No action	Not applicable	Not applicable
Removal	Mechanical transfer	Containerization or transport vehicle
		Pumped
Disposal	Disposal (off-site)	Discharge to local POTW
		Disposal to off-site treatment, storage, and disposal (TSD) facility

5. DEVELOPMENT AND SCREENING OF ALTERNATIVES

In this section, remedial alternatives for wastes, surface and subsurface soil/fill, groundwater, sewer materials, and soil gas at the Site are formed to address the RAOs. The technologies and process options retained in the screening procedures described in Section 4.0 are developed into medium-specific remedial alternatives. These assembled alternatives are then subjected to further screening in Section 6.0. Consideration of the No Action Alternative is required by the NCP.

The remedial alternatives were initially presented in the DASRAT Memorandum (August 28, 2019) conditionally approved by USEPA on February 27, 2020 (Section 1). Since that time, more recent data from the Final RIR, BHHRA, and SLERA along with USEPA comments on the DASRAT have been used to update remedial alternatives.

To develop remedial alternatives for the Site, representative process options were selected across alternatives from the same groups of remedial technologies, as appropriate. However, other process options may still be applicable and should be considered during the remedial design stage of the project. Similarly, quantities of affected materials and footprints for the remedial alternatives described in this section are preliminary estimates based on currently available data. It is anticipated that, where appropriate, additional delineation data may be obtained during remedial design activities, as needed, to more accurately define the extent of materials subject to remedial action.

5.1 Wastes

Wastes at the Site include containerized waste and LNAPL in the USTs and Building #15A. Contaminated soil/fill or groundwater encountered during UST closure is managed under Wastes. Wastes present in other site media are addressed with those media: Manhole 8 is addressed in Section 5.4 (Sewer Water), and NAPL in soil/fill not directly associated with USTs on Lot 63 is addressed in Section 5.2 (Soil/Fill).

Based on the remaining GRAs and process options (Section 4.2), there are two decisions to be made for wastes at the Site in certain remaining process equipment and containers:

- whether or not to take action; and
- if action occurs, what means should be used to remove and dispose of the materials.

Liquid and solid wastes remain at the Site in the various containers, six USTs, and Building #15. Although the risks/hazards associated with these materials have not been quantified, RAOs include securing or removing the materials to the extent practicable, preventing uncontrolled movement of the materials, addressing human and ecological exposure to the materials, and eliminating the principal threat waste. Note that wastes which may be present in other site media (soil/fill or groundwater) are addressed with those media.

5.1.1 Waste Alternative 1 – No Action

Under this alternative, no action would be taken. This alternative is retained for comparison with the other alternatives as required by the NCP. Under no action, remaining source materials at the Site would be left in place, and no means of securing the materials to prevent future release to the environment would be implemented.

5.1.2 Waste Alternative 2 – Removal and Off-Site Disposal

Waste, including NAPLs and LNAPLs, has been identified in certain remaining process equipment, a UST, Building #15A, and miscellaneous containers. (Based on RI laboratory results, the LNAPL is identified as diesel fuel/heating oil and is classified as RCRA non-hazardous for disposal purposes; however, LNAPL is considered a principal threat waste.) This alternative consists of the transfer of wastes into appropriate containers or transport vehicles for off-site recycling or disposal, along with proper closure of USTs by removal. The means of disposal of the various wastes would be determined during the remedial design; however, for the purposes of this FS, certain assumptions can be made, pending disposal characterization.

Within Building #7, a white chalky talc-looking substance remains in an approximately 5-foot diameter hopper that measures approximately 20 feet in height between the first and the second floors. The top of the hopper is accessible from the second floor, and the chalky contents are visible approximately 5 feet below the top. The estimated volume of the solid waste in the hopper is approximately 11 cubic yards (CY). In Building #12, a plastic 55-gallon drum contains approximately 50 gallons of liquid waste. In Building #17, a five-gallon bucket labeled as a filler contains a solid waste. These wastes are characterized as RCRA non-hazardous for disposal purposes; however, they contain hazardous substances that can be released into the environment.

A portion of Building #15A (pump house) contains a petroleum-based liquid (LNAPL) beneath pooled water under a steel grated floor. The LNAPL is approximately 0.5-foot to 0.65-foot thick and very viscous. Assuming that the grate and liquid covers the entire floor plan (approximately 650 SF), and assuming an average thickness of 0.6-foot, the volume of LNAPL in Building #15A is estimated at 2,900 gallons.

There are six USTs located north of Building #12, each measuring approximately 30 feet long by 8 feet in diameter, containing a total of 34,700 gallons of water. One of these USTs (UST-5) contains approximately 1,600 gallons of LNAPL (0.9-foot thick). Based on the depth measurements from the top of the tanks and the approximate dimensions of the tanks, the following table provides estimated volumes as well. The water in the USTs is characterized as RCRA non-hazardous for disposal purposes; however, it contains hazardous substances that can be released into the environment.

Sample Location	Depth to LNAPL (feet)	Depth to Liquid (feet)	Estimated Liquid Elevation (feet AMSL)	Approximate Volume (gallons)
UST-1	NA(1)	4.62	1.8	4,500 (water)
UST-2/3	NA	3.10 / 3.93	3.3 / 2.5	7,200 (water)
UST-4	NA	6.6	-0.2	1,300 (water)
UST-5	3.95	4.85		4,100 (water)
			2.5	1,600 (LNAPL)
UST-6	NA	2.6	3.8	8,100 (water)
UST-7	NA	0.55	5.9	9,500 (water)

1. NA – not applicable.

Upon removal of contents, the USTs would be removed and confirmation soil/fill (including underneath the tank) and groundwater sampling will occur in consideration of New Jersey tank closure regulations and NJDEP Technical Requirements (N.J.A.C. 7:26E-5.1(e)), which states that "The person responsible for conducting the remediation shall treat or remove free product and residual product to the extent practicable, or contain free product and residual product when treatment or removal is not practicable. Monitored natural attenuation of free product and residual product is prohibited."

Contaminated soil/fill/groundwater observed in the excavation after tank removal would be addressed in accordance with New Jersey tank closure regulations. It is assumed that approximately 3,500 CY of NAPL-impacted soil/fill adjacent to the USTs will require excavation and off-site disposal as part of the UST removal. (This volume is based on an area of 6,842 square feet and depth of 13 feet excavation minus the tank volume (or 3,173 CY) with a 10 percent contingency added to account for EPH confirmation sampling, yielding a total volume of 3,500 CY.) The footprint of the UST closure and removal, along with the anticipated footprint of the NAPL-impacted soil/fill area adjacent to the USTs on Lot 64, is presented in Figures 5-1 through 5-6 (the same footprint area is presented on all six figures). It is anticipated that excavation will extend 13 feet bgs. (Removal of NAPL-impacted soil/fill on Lot 63 not directly associated with UST removal is addressed in Section 5.2 (Soil/Fill)). The excavated area would be backfilled with fill material that has contaminant concentrations less than the PRGs and selected considering NJDEP "Fill Material Guidance for SRP Sites" dated April 2015. To prevent soil erosion, the excavated area would be covered with gravel.

The total volume of liquid waste estimated to be removed for off-site disposal is approximately 39,000 gallons: consisting of 55 gallons of waste from Buildings #12 and #17; 2,900 gallons of LNAPL in Building #15A; 1,600 gallons of LNAPL in the UST; and 34,700 gallons of water in the six USTs. The total volume of solid waste estimated to be removed is approximately 3,511 CY: consisting of 11 CY in Building #7 and 3,500 CY of NAPL-impacted soil/fill associated with the UST removal and closure.

5.2 Soil/Fill

As discussed in Section 3.4.1, the footprint for the soil/fill remedial alternatives is based on a single-point compliance and not restricted by lot boundary. Delineation of the area and depth of contamination will be confirmed during the remedial design. Additionally, one area of NAPL-impacted soil/fill on Lot 63 (approximately 310 CY) unrelated to the USTs on Lot 64 would be addressed. Finally, SLERA results indicate unacceptable risks to ecological receptors at Lots 67 and 69 due to COECs in surface soil/fill. (NAPL-impacted soil/fill associated with the USTs on Lot 64 is addressed in Section 5.1.)

The footprint of the soil/fill remedial alternative is approximately 3.62 acres of soil/fill at the Site that is impacted with arsenic, copper, lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, Total PCB, benzene, naphthalene, and/or vinyl chloride. Based on the remaining GRAs and process options (Section 4.2), there are four decisions to be made for soil/fill at the Site:

- whether or not to take action;
- if action occurs, whether to leave the soil/fill in place or to excavate for off-site disposal;
- if the soil/fill is left in place, whether to cover/isolate or treat; and
- what, if any, institutional controls are needed in combination with the selected alternatives.

RAOs include addressing human exposure pathways, ecological pathways, the potential off-site transport, and the potential leaching to groundwater and surface water.

For alternatives which involve excavation or treatment, estimates of soil/fill quantities exceeding a PRG are used, such that remaining soil/fill concentrations would comply with health-based or ARAR-based criteria. Achievement of cleanup levels may be based on these criteria or as otherwise determined during the remedy selection process.

For alternatives involving a surface action such as containment or access restrictions, the entire area of interest was considered due to the small incremental cost associated with increasing the extent of the action for these areas. Actual quantities and extents of affected soil/fill handled during remedial activities may differ, depending on conditions at the time of the remedial action and the target cleanup concentrations. Depending on the remedy selected, sampling and analysis for specific COCs during remedial design and/or remedial action may be used to more accurately define quantities and plan remediation.

5.2.1 Soil/Fill Alternative 1 – No Action

Under this alternative, no action would be taken. This alternative is retained for comparison with the other alternatives as required by the NCP. Under no action, new deed restrictions and other institutional controls would not be implemented, and future use of the subject areas would be unrestricted, except that existing NJDEP-approved institutional and engineering controls would remain intact although they are not enforceable by USEPA.

5.2.2 Soil/Fill Alternative 2 – Institutional Controls and NAPL Removal

For this alternative, deed notices would be recorded on all 15 lots. Existing deed notices would be revised to reflect RI results and existing engineering controls for applicable lots. Deed restrictions are to ensure future use of the Site remains commercial or industrial and identify areas of the Site where contamination exceeds ARARs. Regular site inspections would be performed by the responsible parties to ensure compliance with institutional controls and verify inspection of fencing. Fencing would be maintained and enhanced, as appropriate, in order to limit unauthorized access to the area, minimize exposure to surface soils, and prohibit future use of the area in a manner which may expose human receptors to unacceptable risks/hazards. Other institutional controls include existing zoning and local ordinances associated with use of the Site which would also be reviewed and modified, as appropriate, to ensure compliance with the objectives of this alternative.

Soil/fill with NAPL on Lot 63 will be excavated and disposed off-site under this alternative (assume 310 CY based on 1200 square feet area and a depth of 7 feet bgs where NAPL-impacted soil/fill was observed during installation of a monitoring well). NAPL in soil/fill adjacent to the USTs on Lot 64 is addressed under waste alternatives (Section 5.1). A predesign investigation will be completed to further refine the extent of NAPL in soil/fill on the Lot 63 area shown on Figure 5-1. NJDEP guidance on NAPL-impacted soil/fill will be considered in determining the extent of remedial action during remedial design and documentation of meeting applicable RAOs by the removal action. Specific information on the type of petroleum hydrocarbons could be collected during remedial design for application of NJDEP guidance. For the purposes of the FS, it is assumed approximately 310 CY of soil/fill with NAPL-impacted soil/fill will be removed adjacent to Building #7.

Institutional controls and access restrictions (to be determined during remedial design) will reflect the ongoing business operations at the Site. Access restriction could include fencing, concrete barriers, and guard rail. Figure 5-1 displays the areas subjected to remedial actions under this alternative.

5.2.3 Soil/Fill Alternative 3 – Institutional Controls, Engineering Controls, and NAPL Removal

Alternative 3 combines the institutional controls and NAPL removal from Alternative 2 with engineering controls (cover system) to contain COCs, including lead. In addition, the bulkhead would be reinforced or reconstructed, as appropriate, in order to minimize the potential for interaction between the Site and surface water and minimize soil erosion. Figure 5-2 displays the areas subjected to remedial actions under this alternative.

Capping of contaminated areas consists of the construction of a barrier over/around the contaminated areas. The cap is intended to prevent access to and contact with the contaminated media and/or to control its migration. Impermeable caps, like asphalt caps, also address the soil-to-groundwater pathway by reducing vertical infiltration. Existing building floor slabs in contact with soil/fill are incorporated into the cap. If a building is demolished in the future and its floor slab removed, a new surface barrier could be warranted at that location. An existing deed notice with engineering control (concrete slab) presently exists within portions of the building footprint on Lot 63. Asphalt pavement is the engineering control in the existing Lots 68 and 70 deed notice. Other lots at the Site have concrete or asphalt surface pavement, although not part of a deed notice. During the remedial design, these surfaces would be inspected to determine their suitability to be used as a cover.

Some existing pavement may need to be repaired to be used as an engineering control if the pavement otherwise meets the specifications of the cap design. The use of existing pavement as surface cap would reduce the amount of material resources, as encouraged under Region 2 Clean & Green Policy. Using existing asphalt or concrete pavement reduces the environmental footprint of the remedial action. The listing of concrete as a surface material in this alternative is intended to allow the reuse of existing concrete pavement. It is envisioned that new pavement under this alternative would be asphalt but concrete is an acceptable substitute as it provides the same protection of human health and environment as asphalt. NJDEP does not consider existing cracked and/or deteriorating asphalt, concrete, or building foundations as meeting minimum requirements for appropriate remedial action engineering controls at contaminated sites; however, an existing pavement cover could be an acceptable direct contact remedy if the existing pavement cover is constructed to meet all cap design requirements. USEPA in conjunction with NJDEP will determine if existing surfaces achieve the RAOs.

Two other capping options were retained in the DASRAT Memorandum, including a single-layer cap (such as a soil or asphalt cover) and a combination cap. While both types of cap accomplish the objective of preventing exposure to impacted soil/fill, a single-layer asphalt or concrete cap is judged to be more compatible with the likely long-term future use of the Site. NJDEP technical guidance concerning caps will be considered during design of a cap. Other surface barriers, such as soil or geo-membrane layer, have been screened out because the Site is an active industrial park and its future use is anticipated to be the same. These other surface caps are less suitable for roadways, parking, and material storage occurring at the Site, and also require more maintenance like vegetation control.

Asphalt capping as an engineering control is a typical component of an NJDEP-approved remedy for historic fill and historic fill that has been further impacted from current or historic discharge (NJDEP, 2013, NJDEP, 2014). Accordingly, a site-wide 6-inch asphalt cap (bituminous concrete), along with a 6-inch gravel subbase, is proposed in this alternative to prevent direct exposure to soil/fill. The estimated extent of the site-wide asphalt cap, 5.62 acres including Lots 67 and 69, some of which is currently covered by concrete or asphalt. (Note that the total area of the Site is 7.6 acres, and the area of the existing building is assumed to cover 1.98 acres, so the area anticipated to be capped is 5.62 acres.) Surface water management is a capping component to reduce potential off-site transport of soil/fill with COCs. Different covers may be appropriate for different lots. Use of alternative covers are to be approved by USEPA and be in compliance with state regulations.

The existing bulkhead along the riverfront consists of various materials (steel, wood, concrete), and varies in condition from poor/failing to good, with the wood bulkhead sections generally in the worst condition and the steel and concrete sections generally in the best condition. A geotechnical investigation would be required in the remedial design to evaluate the appropriate options for repairing and/or replacing the bulkhead. For the purposes of this FS, it is assumed that the wood sections would be replaced with new sheet piling tied into the adjacent steel and concrete sections of the wall. Additionally, steel sheeting would be installed along Lots 67 and 63 where a bulkhead is not currently present. (Another option to be considered during the remedial design) is shoreline revetment, which would require sloping the shoreline back (with possible building demolition) and placement of an impermeable liner and R-6 or larger riprap. The cost estimate assumes approximately 800 feet of new sheet piling bulkhead walls would be constructed with an on-water operation (due to the limited space available on-site, assuming no building demolition), and the old sections of bulkhead would be removed and properly disposed.

Design and installation of bulkhead enhancement will incorporate active stormwater discharge pipes as appropriate, and existing inactive river wall pipes would be sealed. During the remedial design, the effective height of the bulkhead wall could be increased with soil/fill berms for surface water management; however, for the cost estimate, the bulkhead is replaced/repaired to current site conditions. Bulkhead enhancement reduces the potential interaction between the Site and the Passaic River and minimizes soil erosion. In the cost estimate, a contingency is allowed to account for the Riverside remedial action being designed implemented after implementation of the remedial design for the Lower 8.3 miles of the Lower Passaic River, constituting Operable Unit 2 (OU2) of the Diamond Alkali Superfund Site. Currently, the OU2 remedial design includes bank-to-bank sediment capping (with a chemical isolation layer) with dredging to accommodate the cap to prevent flooding. The installation of the shoreline revetment option would disturb less river sediment than the sheet pile wall. However, during construction, if the OU2 cap is disturbed by sheet pile placement or other shoreline revetments, it would need to be reconstructed and replaced. The performing parties implementing the remedy at Riverside would have a responsibility to work with the Diamond Alkali OU2 PRPs to repair the cap if it is damaged.

5.2.4 Soil/Fill Alternative 4 – Institutional Controls, Engineering Controls, Focused Removal with Off-Site Disposal of Lead, and NAPL Removal

Alternative 4 combines the institutional controls, engineering controls (capping with bulkhead replacement), and NAPL removal from Alternative 3 with a focused excavation and off-site disposal for lead-impacted soil/fill above the PRG in the vicinity of Building #7. Figure 5-3 provides the major components of this alternative. Alternative 4 focuses on the elevated lead concentrations around Building #7 (6,210 ppm in RI boring B-30, 8,690 ppm in RI boring B-75, and 10,800 ppm in historical boring HF-2). This focused removal occurs predominantly on Lot 63 and Lot 64 and covers approximately 23,000 square feet, or 0.5 acres (refer to Figure A-3 in Appendix A); the delineation of the area will be confirmed during the remedial design. For the cost estimate, the depth of the remedial response is assumed to be 6 feet bgs. The limits of focused excavation will be based on assessment of lead in soil/fill to be removed or managed to achieve cumulative cancer risks less than or within the USEPA NCP risk range (10^{-4} to 10^{-6}) and/or non-cancer HIs at or less than the protection goal of a HI = 1 or to achieve ARAR compliance. The assessment would include RI soil/fill samples along with remedial design samples and/or confirmation samples if necessary. The excavated area would be backfilled with fill material that has contaminant concentrations less than the PRGs and selected considering NJDEP "Fill Material Guidance for SRP Sites" dated April 2015. To prevent soil erosion, the excavated area would be covered with gravel.

The remaining affected soil/fill (Figure 5-3), including lead elsewhere on the Site, would be addressed with a site-wide cap to minimize potential unacceptable human health risks/hazards or ecological risks as described in Alternative 3 (minus the 0.5 acres excavated for the focused lead removal and backfilled).

Excavation adjacent to existing buildings raises building stability considerations. Additional measures would be undertaken to address building stability, including sequential smaller excavation areas around the perimeter of the building. Structural integrity of the building will be identified in the remedial design following an engineering assessment.

5.2.5 Soil/Fill Alternative 5 – Institutional Controls, In-Situ Remediation, Engineering Controls, and NAPL Removal

Alternative 5 combines the institutional controls, engineering controls (capping with bulkhead replacement), and NAPL removal from Alternative 3 with in-situ treatment to address lead along with other contaminants. The footprint of this alternative is 3.62 acres; the cost estimate assumes a depth of contamination of 6 feet bgs to the water table. Delineation of the area along with the depth of contamination will be confirmed during the remedial design. Because of the mixture of inorganic and organic contaminants on Site, an in-situ stabilization/solidification technology is assumed for costing (instead of an in-situ treatment technology). Figure 5-4 presents the major components and areas for Soil/Fill Alternative 5.

Stabilization/solidification would be the most applicable means of treatment. This process would involve the injection and mixing of an appropriate binding agent (such as cement, lime, or kiln dust) using a backhoe or large-diameter auger. Alternatively, an iron sulfide amendment could be used to immobilize the metals as insoluble metal sulfides incorporated into secondary metal precipitates. To protect the in-situ remedy and to cover areas that were inaccessible to treatment, a site-wide cap as described in Soil/Fill Alternative 3 would be constructed.

Note that due to the increase in soil/fill volume inherent with this approach, along with the need to cap treated soils, it may be necessary to remove and properly dispose of the top 12 to 18 inches of soil/fill prior to treatment, so that the elevation of the final surface does not change. Treatability studies and/or pilot test(s) are warranted to determine the most effective binding agent and mixing ratio to treat site soil/fill.

5.2.6 Soil/Fill Alternative 6 – Institutional Controls, Removal with Off-Site Disposal, and NAPL Removal

Alternative 6 combines the institutional controls, and NAPL removal from Alternative 2 with removal and off-site disposal to address lead, along with other contaminants. The footprint of this alternative is 3.62 acres; the cost estimate assumes a depth of contamination of 6 feet bgs to the water table. Delineation of the area along with the depth of contamination will be confirmed during the remedial design. Under this alternative, COC-impacted soil/fill is excavated and transported to a permitted off-site facility for subsequent treatment (if needed) and disposal (Figure 5-5). The excavated areas would be backfilled with fill material that has contaminant concentrations less than the PRGs; selected considering NJDEP "Fill Material Guidance for SRP Sites" dated April 2015; and include appropriate erosion and surface drainage controls. Off-site disposal would likely occur at an appropriately licensed solid waste or hazardous waste landfill, depending on the results of disposal characterization sampling which would be conducted as part of the remedial design. It is anticipated that based on elevated lead levels reported in the RI, soil/fill would require treatment prior to disposal. Figure 5-5 presents the major components and areas for Soil/Fill Alternative 6.

The extent of excavation will be determined during the remedial design phase. The limits of excavation will be based on assessment of soil/fill COCs to be removed or managed to achieve cumulative cancer risks less than or within the USEPA NCP risk range (10^{-4} to 10^{-6}) and non-cancer HIs are at or less than the protection goal of a HI = 1 or to achieve ARAR compliance. The assessment would include RI samples along with remedial design samples and/or confirmation samples if necessary.

Excavation adjacent to existing buildings at depths below the water table, which raises building stability considerations. Additional measures would be undertaken to address building stability, including sequential smaller excavation areas around the perimeter of the building. Structural integrity of the building will be identified in the remedial design following an engineering assessment. If buildings are structurally unsound, an excavation offset may be needed, resulting in a portion of the to-be-excavated soil/fill remaining in-place due to building stability and safety considerations.

5.2.7 Soil/Fill Alternative 7 – Institutional Controls, Ex-Situ Treatment and On-Site Placement, Engineering Controls, and NAPL Removal

Alternative 7 combines the institutional controls, and NAPL removal from Alternative 2 with ex-situ treatment and on-site placement to address lead, which is a Site-related contaminant, along with other contaminants. The footprint of this alternative is 3.62 acres; the cost estimate assumes a depth of contamination of 6 feet bgs to the water table. Delineation of the area along with the depth of contamination will be confirmed during the remedial design. Under this alternative, one or more of several readily implementable and well-developed ex-situ treatment methods would be implemented to treat soil/fill. The specific methods to be implemented for each lot depends on the nature of the contaminants to be treated. Soil/fill would be excavated and treated on-site, with the treated material being placed in the excavation(s); however, elevated lead levels may classify some of the soil/fill as RCRA waste and prevent its reuse on-site. Figure 5-6 displays the areas subjected to remedial actions under this alternative.

For the soil/fills where the primary COC is metals, stabilization/solidification would be the most applicable means of treatment. This process would involve the injection and mixing of an appropriate binding agent (such as cement, lime, or kiln dust) within a constructed aboveground treatment cell or pugmill. After completion of stabilization activities, the treated soil/fill would be placed in the excavation. Note that due to the increase in soil/fill volume inherent with this approach, it may be necessary to remove and properly dispose of the top 12 to 18 inches of soil/fill prior to treatment, so that the elevation of the final surface does not change. Treatability studies and/or pilot test(s) during remedial design are appropriate to determine the most effective binding agent and mixing ratio to treat soil/fill.

For the soil/fill where organics are COCs, soil/fill mixing with a chemical oxidant, such as a persulfate, would be considered the most applicable ex-situ treatment approach. For this option, excavated soil/fill and a slurry of the selected oxidant would be mixed with organic-impacted soil/fill within a constructed aboveground treatment cell. Upon confirmation of meeting treatment goals, the soil/fill would be placed back in the excavation. Treatability studies and/or pilot test(s) would be included as part of the remedial design to evaluate the most effective oxidant for soil/fill in each lot. Where metals and organics are both present above target concentrations, chemical oxidation could be followed by stabilization.

- This alternative includes treatment consistent with the CERCLA preference for treatment to reduce contaminant mobility, toxicity, and volume. However, site-specific conditions at the Site suggest in general that treatment may be impractical, infeasible or not implementable for the following reasons: Some soil/fill contaminants for the Site are copper, arsenic, lead, VOCs, and select PAHs. Metals treatment methods include stabilization/solidification. However, these methods would not significantly reduce the metals concentration in soils (except possibly a minor reduction due to the dilution effect of the stabilization/solidification reagents) and would not reduce the mass of contaminants at the Site. Therefore, stabilization/solidification methods would not meet ARARs for placement on-site of treated soil/fill.
- Technologies for extraction of metals from soil/fill are likely to require treatability/ pilot testing. In addition, the time for treatment would likely delay backfill and restoration of the treated areas or require interim Institutional Controls (Deed Restrictions) if in-situ treatment was used.
- Ex-situ treatment on Site may be impractical or inefficient because of the space constraints at the active industrial park, the likely length of time required to meet RAOs for certain in-situ treatment technologies (and the long-term implication on the businesses of protracted treatment), and access limitations for treatment equipment. If the vacant southern portion of the Site is redeveloped prior to remedial action, the lack of available space negatively impacts implementability of this alternative.

5.3 Groundwater

As discussed in Section 3.4.2, groundwater is not currently used for potable water and is not reasonably expected to be used as a potable source in the future. However, the aquifer underlying the Site is classified by NJDEP as Class IIA, regardless of whether the groundwater is currently being used as a potable source. Hypothetical future potable use of groundwater is presented in the BHHRA for the purpose of ensuring that the FS includes one or more alternatives that are protective of this pathway.

As noted in Section 3.7.3, groundwater in some wells contain COC concentrations above ARAR-based PRGs, including several VOCs, SVOCs, and metals. Elevated levels of lead in the shallow groundwater were observed in monitoring wells in the vicinity of Building #7 and are co-located with elevated lead levels in the soil/fill.

Based on the remaining GRAs and process options (Section 4.2), there are two decisions to be made for groundwater at the Site:

- whether or not to take action to remediate groundwater; and
- if action occurs, whether to pursue passive active remedies.

Secondary decisions must also be made regarding the specific types of focused actions and treatment/disposal methods for waste products generated during remediation. Where multiple process options are available within a class of response actions (such as in-situ treatment) and the options are expected to have similar effectiveness and protectiveness, the more common and/or less costly method was selected for evaluation as part of a remedial alternative. Should such an alternative be selected for the Site remedy, site-specific bench and/or pilot studies may be appropriate to determine the most cost-effective process option. These choices are considered in developing the alternatives and are based on the magnitude of COC concentrations above human health-based and ARAR-based cleanup levels, the quantity of affected material, and the potential for additional aquifer degradation due to cross-media effects from soil/fill. RAOs include reduction of contaminant concentrations and restoration of groundwater quality, mitigating exposure to and migration of groundwater containing COCs, and preventing or minimizing discharge of groundwater containing COCs to surface water. As previously discussed, groundwater is not currently used for potable water and is not reasonably expected to be used as a potable source in the future. However, the aquifer underlying the Site is classified by NJDEP as Class IIA, regardless of whether the groundwater is currently being used as a potable source. Hypothetical future potable use of groundwater is presented in the BHHRA for the purpose of ensuring that the FS includes one or more alternatives that are protective of this pathway.

It is noted that LNAPL has not been observed in groundwater wells at the Site, but was observed at one temporary wellpoint. NAPL-impacted soil/fill is addressed in the waste and soil/fill alternatives.

5.3.1 Groundwater Alternative 1 – No Action

Under this alternative, no action would be taken to reduce the potential for unacceptable exposures of humans to impacted groundwater or minimize further aquifer degradation. Existing NJDEP-approved institutional controls would remain intact although they are not enforceable by USEPA. This alternative is retained for comparison with the other alternatives as required by the NCP.

5.3.2 Groundwater Alternative 2 – Institutional Controls, Site Containment at River Edge, and Pump and Treat

Groundwater Alternative 2 includes placement of institutional controls on the entire Site, a physical barrier (wall) constructed at the river edge, and an active pump and treat groundwater remedy to achieve ARARs. Interaction with the existing CEAs and WRAs would be coordinated with NJDEP, along with LSRPs and responsible parties for these controls. USEPA cannot enforce existing NJDEP CEAs and WRAs. The existing CEAs provide notice that groundwater in the area does not meet designated use requirements, and the existing WRAs prohibit the installation and use of wells for potable and other uses within the designated area. During remedial design, groundwater samples will be collected, analyzed, and reported to update shallow fill and deep groundwater quality. Updated results will be used for site-wide institutional controls and establishment of a site-wide CEA and WRA. Periodic monitoring and reporting to demonstrate compliance with the restrictions is part of this alternative.

A vertical sheet pile barrier wall would be constructed along the river's edge as a means of reducing the potential for interaction between groundwater and the river. Sheet piling would be constructed to the top of an underlying confining layer, most likely the glacial lake bottom silt deposits, with a depth to be determined during remedial design. The barrier wall would have a total length of approximately 1,300 feet. The barrier wall is not intended to address geotechnical issues related to property redevelopment or to enhance the structural stability of the current bulkhead. A geotechnical investigation will occur during remedial design to determine wall alignment, depth, and specifications.

Additionally, approximately 20 extraction wells would be installed throughout the Site to alleviate hydrostatic pressure behind the barrier wall and to recover both shallow and deep groundwater impacted by organics and shallow groundwater impacted by metals (including lead). Extracted groundwater would be pumped to a new groundwater treatment facility, likely at least 5,000 to 7500 SF in floor area, to be constructed at an appropriate location on the Site.

The number of extraction wells, pumping rate, and individual processes to be utilized for treatment will be determined during the remedial design. For the purposes of this FS, a 200-gallon per minute (GPM) system (i.e., 20 wells at 10 GPM per extraction well) including chemical oxidation, filtration, metals precipitation (chemical), and carbon polishing is assumed. Approval and/or permit equivalency would be sought for discharge of treated water to the local POTW or surface water. Figure 5-7 presents the major components and areas for Groundwater Alternative 2.

This alternative would be challenged from the on-going dissolution of residual COC in the soil/fill to groundwater that would need to be treated; however, other alternatives with source control measures (i.e., UST removal and removal of elevated lead in the vicinity of Building #7), if implemented, would remove potential groundwater sources, potentially allowing the pump and treat system to achieve RAOs faster.

5.3.3 Groundwater Alternative 3 – Institutional Controls and In-Situ Remediation

Alternative 3 includes the institutional controls described for Groundwater Alternative 2. Additionally, impacted groundwater would be subject to in-situ remediation. The objective of this alternative is to reduce COC concentrations (organic and inorganic) in groundwater, eventually restoring groundwater quality. Figure 5-8 presents the major components and areas for Groundwater Alternative 3. Ongoing groundwater monitoring would be performed to demonstrate that the selected remedy continues to be protective of human health and the environment

For organic COCs, the most likely in-situ treatment methods include in-situ chemical treatment, biosparging, and air sparging. Pilot- and bench-scale testing would be required as part of the remedial design to determine the most appropriate treatment approach and reagents for site groundwater. However, tidal influences and brackish water quality effects on in-situ treatment may limit effectiveness and may need to be assessed. Chemical oxidation is generally preferred over reductive dechlorination due to the presence of arsenic and the likely decrease of arsenic mobility with increasing oxidation state. For the purposes of this FS, injection of an oxidant amendment in the shallow and deep aquifers is assumed.

Metal COCs in groundwater are less amenable for in-situ remediation because they cannot be destroyed, but only changed in form or become attached to particles. For the purposes of this FS, injection of an iron sulfide amendment to form metal sulfide complexes in the soil/fill is assumed. The iron sulfide amendment will target lead, - causing it to form a complex and precipitate out of the groundwater.

In-situ remediation using iron sulfide for chemical reduction will likely precipitate out some of the metal COCs (primarily lead) present in soil and groundwater and may promote chemical reduction of select VOCs (such as TCE and PCE). In addition, the application of an in-situ oxidant as proposed here and Soil Gas Alternative 3, could result in the destruction of VOC COCs, like BTEX and acetone, and may chemically oxidize some of the remaining VOCs (such as vinyl chloride). Neither of the proposed in-situ approaches has been shown to successfully treat SVOC COCs, including 1,4 dioxane.

It should be recognized that many of the COCs are co-located or are in close proximity, and the in-situ treatment compounds (iron sulfide) require very different geochemical conditions to be present in the area to be effective. The different geochemical conditions would complicate the approach and require either spatially discrete applications of either chemical reductants and oxidants, or temporally discrete manipulations of the aquifer geochemistry. It would not be reasonable to assume that an area can be treated with an oxidant and then the geochemistry modified to allow treatment with a reducing agent. Additional groundwater sampling and performance of treatability studies would be required as part of the remedial design to evaluate and select the most cost-effective means for addressing both organic and inorganic constituents in groundwater, including means of reagent delivery to the subsurface and evaluation of tidal influences on that delivery to prevent transport of reagent off-site. This alternative does not eliminate the need for institutional controls or reduce their expected duration.

This alternative would be challenged from the on-going dissolution of residual COC in the soil/fill to groundwater that would need to be treated; however, other alternatives with source control measures (i.e., UST removal and removal of elevated lead in the vicinity of Building #7), if implemented, would remove potential groundwater sources, potentially allowing in-situ remediation to achieve RAOs faster.

5.3.4 Groundwater Alternative 4 – Institutional Controls, Pump and Treat, and Targeted Periodic In-Situ Remediation

This alternative combines the institutional controls and site-wide pump and treat system of Groundwater Alternative 2 (with no barrier wall), and a targeted, periodic in-situ treatment approach for upgradient portions of the Site generally described in Groundwater Alternative 3. Figure 5-9 presents the major components and areas for Groundwater Alternative 4.

As with Groundwater Alternative 2, the pumping wells near the river would be located based to provide hydraulic containment at the river's edge to capture groundwater COC at concentrations exceeding ARARs. Hydraulic heads in the shallow and deep aquifer would be monitored, and the extraction rates would be variable, to provide maximum containment/capture without causing excessive induced infiltration from the river. Upgradient wells could be located to capture groundwater COC at concentrations exceeding ARARs. The number of extraction wells, pumping rate, and individual processes to be utilized for treatment will be determined during the remedial design. For the purposes of this FS, a 200-gallon per minute (GPM) system (i.e., 20 wells at 10 GPM per extraction well), including chemical oxidation, filtration, metals precipitation (chemical), and carbon polishing, is assumed. Approval and/or permit equivalency would be sought for discharge of treated water to the local POTW or surface water.

As with Groundwater Alternative 3, the extent of groundwater to be addressed by targeted, periodic in-situ applications and the specific means for addressing would be determined during the remedial design, including additional groundwater sampling and the performance of treatability studies. For costing purposes, this alternative assumes targeted, periodic in-situ applications would occur annually during the first five years of operation, and the effectiveness of the various approaches will be evaluated and modified, as needed, between each event. The overall effectiveness of the remedy, including the performance of each in-situ application, would be evaluated during the first 5-year review. Under this currently envisioned hybrid approach, periodic in-situ remediation would be focused on the upgradient portion of the Site, targeting metals in the shallow unit and organics in both the shallow and deep units. During the periodic injections, pumping at upgradient wells may be temporarily reduced or halted, as appropriate, to give the amendments adequate contact time with COCs in the aquifer(s). As above, a means of chemical oxidation for organics and fixation of metals using iron sulfide is assumed, and spatial or temporal separation of in-situ events (as discussed in Groundwater Alternative 3) would be more readily addressed under this framework. In any area where in-situ treatment will not achieve PRGs, regardless of the location on-site, pump and treat will be relied upon to achieve the remedial objectives. To prevent uncontrolled release of injection fluids into the river, injection wells along the river may not be a viable option. Tidal influence of groundwater levels, especially near the river, could reduce injection volumes because of less free space in a well for injection during high tides. Ongoing groundwater monitoring would be performed to demonstrate that the selected remedy continues to be protective of human health and the environment.

This alternative would be challenged from the on-going dissolution of residual COC in the soil/fill to groundwater that would need to be treated; however, other alternatives with source control measures (i.e., UST removal and removal of elevated lead in the vicinity of Building #7), if implemented, would remove potential groundwater sources, potentially allowing the pump and treat system to achieve RAOs faster.

5.3.5 Groundwater Alternative 5 – Institutional Controls, Site Containment at River Edge and Focused In-Situ Remediation

This alternative combines the institutional controls and barrier wall of Groundwater Alternative 2 with focused in-situ remediation implemented in higher VOC, SVOC and lead concentration areas. Groundwater Alternative 5 uses the same in-situ remediation technology as presented in Groundwater Alternatives 3 and 4; however, Groundwater Alternative 5 targets specific areas of the Site (refer to Figure 5-10) and does not address Site-wide groundwater contamination as presented in Groundwater Alternatives 3 and 4. This alternative includes a vertical barrier wall along the river edge is to reduce the potential interaction between groundwater and the river (Figure 5-10) as presented in Groundwater Alternative 2; however, it does not include a pumping system to alleviate potential hydrostatic pressure behind the barrier wall, which may result in groundwater undermining or circumventing the barrier wall as it flows east towards the river. Based on the permeable nature of the fill, the preferred groundwater flow pathway would be a more southern path from current condition as the wall blocks east flow. This southern flow path would eventually continue to flow east; as stated in the RI Report Section 3.4, the Passaic River is a regional discharge point for groundwater in the Newark, New Jersey area. Consequently, the barrier wall is unlikely to prevent interactions between the groundwater and the river.

Ongoing groundwater monitoring would be performed to demonstrate that the selected remedy continues to be protective of human health and the environment.

The extent of focused in-situ remediation (Figure 5-10) will be determined during the remedial design, with the intent being to address those portions of groundwater that are most amenable to in-situ treatment, i.e., concentrations exceeding ARARs primarily on Lots 63/64 and Lot 58 of organic constituents and lead. A means of chemical oxidation for organics and fixation of lead using iron sulfide is assumed as discussed in Groundwater Alternative 3. The remaining groundwater would be subject to the restrictions of the site-wide CEAs/WRAs (i.e., institutional controls); consequently, this alternative would not be compliant with chemical-ARAR, since no active remedy would be applied to address groundwater contamination across the Site. For the purposes of this FS, the remediation is assumed to be targeted to areas with VOCs, SVOCs, and lead.

5.3.6 Groundwater Alternative 6 – Institutional Controls and Site Containment

This alternative combines the institutional controls of Groundwater Alternative 2 with engineering controls to isolate contaminated groundwater from the environment and reduce potential hydraulic communication with off-site surface water. As noted in the RI, groundwater may migrate in the direction of shallow groundwater flow which, for this Site, is primarily toward the Passaic River. Tidal fluctuations affect the rate of shallow groundwater migration toward the river, as during high tide river water migrates into the shallow groundwater. Figure 5-11 presents the major components and areas for Groundwater Alternative 6.

Slurry walls and grout curtains are not feasible for this alternative because of implementability complexities, substantial preparation work that would be undertaken, and disruption of existing business. Slurry walls and grout curtains would be offset from river edge by 10 feet, maybe more based upon remedial design geotechnical investigation findings, and to prevent uncontrolled slurry or grout movement due to void spaces along the bulkhead. This 10-foot offset alignment would require at least another 10 feet of working space for installation. This working space from river would necessitate the demolition of vacant (Building #7) and occupied buildings (Buildings #15 and #17). In addition, subsurface utility lines exist along the bulkhead that would need to be relocated. Because the slurry wall/grout curtain is offset from the river, soil/fill will be outside of slurry wall/grout curtain.

Sheet piling surrounding the entire Site would be constructed to the top of an underlying confining layer, most likely the glacial lake bottom silt deposits starting between 20 and 40 feet below grade. The wall depth, design, and alignment will be determined during remedial design. A geotechnical investigation would be conducted during remedial design also. The purpose of the vertical barrier wall is to reduce lateral groundwater migration and river water infiltration and isolate contaminated groundwater from the environment. The mitigation/infiltration would be addressed for both shallow fill and deep groundwater. The sheet piling is not intended to address geotechnical issues related to property redevelopment or to enhance the structural stability of the current bulkhead. The alignment of the sheet piling is shown on Figure 5-11.

Additionally, unpaved portions of the Site would be covered with a low-permeability cap considering NJDEP guidance to reduce infiltration of precipitation and address the soil/fill to groundwater pathway. Where existing paved areas meet the to-be-developed specifications for a containment cap, they would remain intact and would be incorporated into the cap system. Appropriate deed restrictions would be implemented to prevent disturbance of the cap and vertical barrier. This alternative would be implemented for the entire Site.

5.3.7 Groundwater Alternative 7 – Institutional Controls, Site Containment at River Edge and Monitored Natural Attenuation

Groundwater Alternative 7 combines the institutional controls and physical barrier (wall) constructed at the river edge described for Groundwater Alternative 2 with the natural degradation of COCs in the aquifer by natural biological, chemical, and/or physical processes. Figure 5-12 presents the major components and areas for Groundwater Alternative 7.

An assessment of the potential occurrence of MNA processes was not conducted as part of the RI. Nonetheless, groundwater monitoring focused on MNA processes during the remedial design is included in this alternative. MNA would be challenged from the on-going dissolution of residual COC in the soil/fill to groundwater that would need to be addressed; however, other alternatives with source control measures (i.e., UST removal), if implemented, would remove potential groundwater sources, allowing MNA to achieve RAOs eventually. Natural attenuation reduces the potential risk/hazard posed by groundwater contaminants over time in three ways:

1. Transformation of contaminant(s) to a less toxic form through destructive processes, such as biodegradation or abiotic transformations (which would not have an effect on lead);
2. Reduction of contaminant concentrations whereby potential exposure levels may be reduced; and
3. Reduction of contaminant mobility and bioavailability through sorption onto the soil/fill.

Ongoing groundwater monitoring would be performed to confirm that these natural processes are occurring, and that this alternative continues to be protective of human health and the environment. As part of the monitoring program, the installation of additional groundwater monitoring wells may be appropriate. If LNAPLs are observed in Site groundwater, then MNA would not apply to LNAPL within that area.

5.4 Sewer Water

As discussed in Section 3.5, sewer water and associated solids in an inactive portion of the northern sewer line (Manhole 8) on Lot 1 are wastes. Manhole 8 measures approximately 4 feet by 4 feet in plan and approximately 6 feet deep. Nine 4-inch diameter steel pipe terminations were identified in Manhole 8, only one of which was not blocked. Approximately 1.2 feet of sewer water and solids were present within the base of the manhole during sampling events in March and December 2018, or approximately 0.75 CY of combined water and solids (of this volume, approximately 50 percent or 0.4 CY is estimated to consist of solids). The water sample had methylene chloride and TCE above groundwater PALs. Methylene chloride and toluene concentrations in the solids were above 1 mg/kg, and TCE was reported at a concentration of 26 µg/kg in the solids sample.

Based on the remaining GRAs and process options (Section 4.2), there are two decisions to be made for sewer water and solids:

- whether or not to take action; and
- if action occurs, what means should be used to remove and dispose of the materials.

VOC-impacted sewer water and solids in an inactive portion of the northern sewer line at Manhole 8 on Lot 1 are potential source materials if released to the environment. Although the risks/hazards associated with these materials have not been quantified in the BHHRA, the RAOs include preventing exposure to a release of the materials, reducing COC concentrations in the water, and preventing or minimizing the discharge of sewer water COCs to surface water.

Note that the solids are considered a waste, but for the purposes of this FS, those solids are addressed with the sewer water, as they are co-located.

5.4.1 Sewer Water Alternative 1 – No Action

Under this alternative, no action would be taken. This alternative is retained for comparison with the other alternatives as required by the NCP. Under no action, the water and solids in the designated section of sewer and associated line would be left in place, and no means of securing the materials to prevent future release to the environment would be implemented.

5.4.2 Sewer Water Alternative 2 – Removal and Off-Site Disposal

This alternative consists of the transfer of the sewer water and solids (approximately 0.75 CY) into appropriate containers or transport vehicles for off-site treatment and/or disposal along with proper closure of the line. The means for disposal of the various wastes would be determined during the remedial design; however, for the purposes of this FS, certain assumptions can be made, pending disposal characterization. Liquid materials would be pumped into drums and transferred to an appropriate facility for treatment and disposal. Remaining solids in the manhole would be vacuumed into a drum and disposed of in an appropriate solid waste landfill.

Upon removal of the contents, the interior of the manhole and associated line would be water-jetted, and then closed in place by plugging/filling to prevent future buildup of water and solids in the manhole. Cleaning of the manhole and the one unplugged pipe (assumed to be 125 linear feet) would generate an estimated 2,500 gallons of additional liquid (assuming a triple rinse).

5.5 Soil Gas

As indicated in the BHHRA, risks/hazards to future indoor workers from soil gas intrusion are unacceptable at Lots 58 (TCE and xylenes), 62 (naphthalene), and 68 (TCE and xylenes). Response actions may also be appropriate for areas in addition to these lots where concentrations of naphthalene, total xylenes, and TCE exceed PRGs for soil gas and may present a potential risk/hazard for future indoor workers in future occupied buildings. The footprint of the soil gas remedial alternatives is based on a single-point compliance to the PRG presented in Appendix A; delineation of the area will be confirmed during the remedial design. Footprints are provided separately for naphthalene, total xylene, and TCE, with a composite footprint yielding a total area of 3.77 acres. Approximately 52 percent of this total area, or 1.95 acres, is within 100 feet of an existing occupied building.

Based on the remaining GRAs and process options (Section 4.2), there are two decisions to be made for soil gas at the Site:

- whether or not to take action; and
- if action occurs, whether to pursue limited action, passive remedies or active remedies.

The RAO includes minimizing soil gas levels that may migrate to indoor air of overlying buildings. Remedial action includes existing occupied buildings and areas across the Site that may support a future occupied building. In addition, since shallow groundwater levels exceed the NJDEP VISL levels, any existing or future building within a 100-foot radius from the monitoring well will warrant further investigation for potential vapor intrusion. The boundary would be delineated from the edge of the plume per NJDEP VISL guidance.

Alternatives to directly address the sources of the soil gas, such as through soil/fill excavation or in-situ remediation are discussed in Section 5.2. The treatment alternatives described in this section relate to the treatment of soil gas COCs after removal from the ground, if such treatment is required to meet ARARs with respect to off-gas emissions.

5.5.1 Soil Gas Alternative 1 – No Action

Under this alternative, no action would be taken. This alternative is retained for comparison with the other alternatives as required by the NCP. Under no action, no measures would be taken to protect future indoor workers from exposure to organic soil vapors.

5.5.2 Soil Gas Alternative 2 – Institutional Controls, Air Monitoring or Engineering Controls (existing occupied buildings) and Site-Wide Engineering Controls (future buildings)

This alternative consists of establishing or enhancing deed notices and/or CEAs site-wide (which will address the footprint presented in Appendix A where concentrations of naphthalene, total xylene, and TCE exceed the soil gas PRG) to provide certain restrictions upon the use of the property. Such restrictions (institutional controls) would require that prior to existing buildings being occupied in the future, a building-specific assessment of sub-slab soil gas and/or indoor air quality would be performed and, if needed, some means of protecting the future occupants of such existing buildings from vapor intrusion risks/hazards would be implemented. Additional restrictions would require that future new construction include a vapor barrier or other appropriate means of sealing the ground surface underneath the new building slab or installation of a SSDS.

Ongoing indoor air monitoring or engineering controls (such as a SSDS) would be required in the seven existing occupied buildings to confirm previous assessment results and/or to ensure the indoor workers are protected, due to the presence of soil gas or VOCs in groundwater above NJDEP VISLs in shallow monitoring wells within 100 feet of the building.

Figure 5-13 presents the major components and areas for Soil Gas Alternative 2.

5.5.3 Soil Gas Alternative 3 – Institutional Controls, Site-Wide Engineering Controls (future buildings), and Air Monitoring or Engineering Controls and In-Situ Remediation of Soil/Fill (existing occupied buildings)

This alternative includes the site-wide institutional controls and continued air monitoring or engineering controls for existing occupied and future buildings associated with soil gas and VOCs in groundwater above NJDEP VISLs, as described for Soil Gas Alternative 2.

However, in lieu of air monitoring and engineering controls (SSDS) for existing occupied buildings, this alternative allows for in-situ remediation (see Appendix A) of soil/fill containing TCE, total xylenes, and naphthalene above the PRG (Figure 5-14) within 100 feet of those buildings. This alternative assumes a remedial footprint of 1.95 acres with an estimated depth to groundwater of 6 feet. In-situ remediation of the designated soil/fill would be performed as described under Soil/Fill Alternative 5 (assuming chemical oxidation injection). Remaining soil/fill with VOCs above the associated PRGs (i.e., not within 100 feet of existing occupied buildings) is addressed by the site-wide institutional controls requiring assessment and, if needed, mitigation prior to occupancy of existing buildings, and site-wide engineering controls for future construction. Figure 5-14 presents the major components and areas for Soil Gas Alternative 3.

5.5.4 Soil Gas Alternative 4 – Institutional Controls, Site-Wide Engineering Controls (future buildings), and Air Monitoring or Engineering Controls and Removal/Off-Site Disposal of Soils (existing occupied buildings)

This alternative includes the site-wide institutional controls and continued air monitoring or engineering controls for existing occupied and future buildings associated with soil gas and VOCs in groundwater above NJDEP VISLs, as described for Soil Gas Alternative 2.

In lieu of air monitoring and engineering controls (SSDS) for existing occupied buildings, this alternative allows for removal and off-site disposal (see Appendix A) of soil/fill containing TCE, total xylenes and naphthalene above the PRG (Figure 5-15) within 100 feet of those buildings. This alternative assumes a remedial footprint of 1.95 acres with an estimated depth to groundwater of 6 feet. Removal of the designated soil/fill would be performed as described under Soil/Fill Alternative 6. Remaining soil/fill with VOCs above the associated PRGs (i.e., not within 100 feet of existing occupied buildings) is addressed by the site-wide institutional controls requiring assessment and, if needed, mitigation prior to occupancy of existing buildings, and site-wide engineering controls for future construction. Figure 5-15 presents the major components and areas for Soil Gas Alternative 4.

5.5.5 Soil Gas Alternative 5 – Institutional Controls, Site-Wide Engineering Controls (future buildings), and Air Monitoring or Engineering Controls and Ex-Situ Treatment and On-Site Placement of Soil/Fill (existing occupied buildings)

This alternative includes the site-wide institutional controls and continued air monitoring or engineering controls for existing occupied and future buildings associated with soil gas and VOCs in groundwater above NJDEP VISLs, as described for Soil Gas Alternative 2.

In lieu of air monitoring and engineering controls (SSDS) for existing occupied buildings, this alternative allows for ex-situ treatment and on-site placement (i.e., beneficial reuse) (see Appendix A) of soil/fill containing TCE, total xylenes and naphthalene (Figure 5-16) within 100 feet of those buildings. This alternative assumes a remedial footprint of 1.95 acres with an estimated depth to groundwater of 6 feet. Removal, treatment (with chemical oxidation), and replacement of the designated soil/fill would be performed as described under Soil/Fill Alternative 7. Remaining soil/fill with VOCs above the associated PRGs (i.e., not within 100 feet of existing occupied buildings) is addressed by the site-wide institutional controls requiring assessment and, if needed, mitigation prior to occupancy of existing buildings, and site-wide engineering controls for future construction. Figure 5-16 presents the major components and areas for Soil Gas Alternative 5.

5.6 Screening of Alternatives

In an FS, a preliminary screening evaluation of assembled alternatives can be performed to reduce the number of alternatives that will undergo a more thorough and extensive analysis. This screening was performed and included a general evaluation of effectiveness, implementability and cost for each alternative, and alternatives would be screened out if judged to be either not effective, not implementable, or with costs far out of line with respect to the apparent benefits of the alternative, relative to the other alternatives. A summary of this screening evaluation is included in Table 5-1 and is briefly described below. Note that the No Action alternatives are required to be carried forward to the detailed analysis, even though in most cases such alternatives are considered not effective.

5.6.1 Waste

Both waste alternatives are retained for detailed analysis of alternatives in Section 6:

- Waste Alternative 1 – No Action
- Waste Alternative 2 – Removal and Off-Site Disposal.

5.6.2 Soil/Fill

Seven alternatives were assembled for consideration in addressing risks/hazards associated with soil/fill at the Site. Of these seven alternatives, two were removed from further consideration because they were not implementable. Among them, Soil/Fill Alternatives 6 (Institutional Controls, Removal with Off-Site Disposal, and NAPL Removal) and 7

(Institutional Controls, Ex-Situ Treatment and On-Site Placement, Engineering Controls, and NAPL Removal) are judged to be not implementable and having costs not commensurate with the expected benefit. Both of these alternatives require the excavation of substantial volumes of soil/fill at depths of up to 11 feet, which is well below the water table and the adjacent river level and would require significant dewatering and water handling and treatment, particularly for the approximately 800 linear feet of excavations that would be performed immediately adjacent to the river.

Underground utilities, limited access space between buildings, and between the buildings and the bulkhead will restrict implementability of removal in Alternatives 6 and 7. Excavation adjacent to existing buildings would require an assessment of building stability or result in an excavation offset that would result in contaminant mass remaining on Site. In addition, the Site also does not provide enough space for the construction of an ex-situ treatment facility without building demolition, which would affect the implementability of Alternative 7. On-site placement may also be impacted by elevated lead levels in the soil/fill, which may classify the removed soil/fill as a RCRA waste, thus preventing beneficial use options. Accordingly, Soil/Fill Alternatives 6 and 7 are removed from further consideration.

The following five soil/fill alternatives are retained for detailed analysis of alternatives in Section 6:

- Soil/Fill Alternative 1 – No Action
- Soil/Fill Alternative 2 – Institutional Controls and NAPL Removal
- Soil/Fill Alternative 3 – Institutional Controls, Engineering Controls, and NAPL Removal
- Soil/Fill Alternative 4 – Institutional Controls, Engineering Controls, Focused Removal and Off-Site Disposal of Lead, and NAPL Removal
- Soil/Fill Alternative 5 – Institutional Controls, Engineering Controls, In-Situ Remediation, and NAPL Removal

5.6.3 Groundwater

Seven alternatives were assembled for consideration in addressing risks/hazards associated with groundwater at the Site. Of these seven alternatives, three were removed from further consideration because they were either not implementable or did not address site-wide groundwater contamination.

Groundwater Alternative 7 (Institutional Controls, Containment at River Edge, and MNA) is judged not effective because a barrier wall without a pumping system to alleviate hydrostatic pressure is not feasible and because MNA is not readily effective for lead. While it is recognized that there were some variability in the RI groundwater data, suggesting reductions in select VOCs, SVOCs, and metals during the 11-month sampling period, these variations do not necessarily support MNA as an ongoing process capable of reducing all COCs (particularly lead) to acceptable concentrations. Moreover, laboratory variability, seasonal variability, or tidal variability may be responsible for the sporadic variations observed in the RI data, rather than natural attenuation. The evaluation of MNA as a remedial alternative requires robust site-specific geochemical data to evaluate the attenuation potential of all contaminants on the Site; this option requires a far more robust conceptual site model than is typically required at most sites. This Site has a complex mixture of COCs, which would require the following general conditions to be present: chemical or biological processes that result in the sequestration of lead (i.e. precipitation, coprecipitation, or adsorption); chemical or biologic processes that result in the destruction of organic compounds; or abiotic processes (such as hydrolosis or dehydrohalogenation) that result in the dechlorination of chlorinated VOCs. Many of these constituents are co-located and may potentially impact (negatively or positively) the MNA processes. Additionally, there are compounds present onsite at concentrations above ARARs, that have not been demonstrated to respond favorably to MNA (e.g., SVOCs such as 1,4-dioxane, and PCBs). MNA is not a viable process option for NAPL if it is observed in groundwater per Subchapter 5 of the N.J.A.C. 7:26E.

Groundwater Alternative 5 (Institutional Controls, Containment at River Edge, and Focused In-Situ Remediation) is judged to be not implementable and not effective because (1) the focused in-situ remediation primarily addresses groundwater contamination on Lots 63/64 and Lot 58; (2) The remaining groundwater would be subject to the restrictions of the site-wide CEAs/WRAs (i.e., institutional controls); consequently, this alternative would not be compliant with chemical-ARAR, since no active remedy would be applied to address groundwater contamination across the site; and (3) consistent with the rationale presented for Groundwater Alternative 7, the barrier wall requires hydraulic control of COCs and hydrostatic relief behind the containment structure to prevent COCs from circumventing the structure, as well as potential structural failure.

Groundwater Alternative 6 (Institutional Controls and Site Containment) is judged to be not implementable, given the need to construct an impermeable vertical barrier around the entire Site, which may require building(s) demolition depending on wall alignment. Given the numerous underground utilities at the Site and the proximity of several buildings to the property line and roadways to the west, it is uncertain whether an effective barrier can be constructed along much of the western boundary of the Site, and access from adjacent property owners may be needed. Accordingly, Groundwater Alternatives 6 and 7 are removed from further consideration.

The following four groundwater alternatives are retained for detailed analysis of alternatives in Section 6.0:

- Groundwater Alternative 1 – No Action
- Groundwater Alternative 2 – Institutional Controls, Site Containment at River Edge, and Pump and Treat
- Groundwater Alternative 3 – Institutional Controls and In-Situ Remediation
- Groundwater Alternative 4 – Institutional Controls, Pump and Treat, and Targeted Periodic In-Situ Remediation

5.6.4 Sewer Water

Both sewer water alternatives are retained for detailed analysis of alternatives in Section 6:

- Sewer Water Alternative 1 – No Action
- Sewer Water Alternative 2 – Removal and Off-Site Disposal

5.6.5 Soil Gas

Five alternatives were assembled for consideration in addressing risks/hazards associated with soil gas at the Site. Among them, Soil Gas Alternatives 4 and 5 provide an option of removal with off-site disposal (Alternative 4) or ex-situ treatment with on-site placement (Alternative 5) in lieu of air monitoring and engineering controls to address potential indoor air risks/hazards to existing occupied buildings, which are judged to be not implementable and having costs not commensurate with the expected benefit (compared to air monitoring or engineering controls). In addition, similar to the Soil/Fill Alternatives, underground utilities, limited access space between buildings, and between the buildings and the bulkhead will restrict implementability of removal in Alternatives 4 and 5. Excavation adjacent to existing buildings would require an assessment of building stability or result in an excavation offset that would result in contaminant mass remaining on Site. In addition, the Site also does not provide enough space for the construction of an ex-situ treatment facility without building demolition, which would affect the implementability of Alternative 5. On-site placement may also be impacted by elevated lead levels in the soil/fill, which may classify the removed soil/fill as a RCRA waste, thus preventing beneficial use options. Accordingly, Soil Gas Alternatives 4 and 5 are removed from further consideration. The following three alternatives are evaluated in the detailed analysis of alternatives in Section 6:

- Soil Gas Alternative 1 – No Action
- Soil Gas Alternative 2 – Institutional Controls, Air Monitoring or Engineering Controls (existing occupied buildings), and Site-Wide Engineering Controls (future buildings)
- Soil Gas Alternative 3 – Institutional Controls, Site-Wide Engineering Controls (future buildings), and Air Monitoring or Engineering Controls and In-Situ Remediation of Soil/Fill (existing occupied buildings)

6. DETAILED ANALYSIS OF ALTERNATIVES

6.1 Evaluation Criteria

In this section, the alternatives developed in Section 5 for various media at the Site are described and evaluated in detail. The detailed analysis of alternatives provides information to aid in the comparison among alternatives and the selection of the final recommended alternative. This analysis is performed in accordance with the USEPA RI/FS Guidance Document (USEPA, 1988) and the NCP, as revised by 55 Federal Register 8813 (March 8, 1990). In conformance with the NCP, the following nine criteria (two threshold criteria, five balancing, and two modifying criteria) are used in the final analysis:

- Overall protection of human health and the environment (threshold criterion);
- Compliance with ARARs (threshold criterion);
- Long-term effectiveness and permanence (balancing criterion);
- Reduction of TMV by treatment (balancing criterion);
- Short-term effectiveness (balancing criterion);
- Implementability (balancing criterion);
- Cost (balancing criterion);
- State (support agency) acceptance (modifying criterion); and
- Community acceptance (modifying criterion).

These criteria are described below, before performing the detailed analysis of the alternatives.

6.1.1 Overall Protection of Human Health and the Environment

Each alternative is assessed to determine whether it can provide adequate protection of human health and the environment (short- and long-term) from unacceptable risks/hazards posed by hazardous substances, pollutants, or contaminants present at the Site. Evaluation of this criterion focuses on how site risks/hazards are eliminated, reduced, or controlled through treatment, engineered controls, or institutional controls and whether an alternative poses any unacceptable cross-media impacts.

6.1.2 Compliance with ARARs

Section 121(d) of CERCLA, 42 U.S. Code § 9621(d), the NCP, 40 CFR Part 300 (1990), and guidance and policy issued by USEPA require that remedial actions under CERCLA comply with substantive provisions of ARARs from the state and federal environmental laws and State facility siting laws during and at the completion of the remedial action, unless such ARARs are waived. The definition and identification of ARARs have been described and discussed in detail in Section 3.2. Three classifications of requirements are defined by USEPA in the ARAR determination process. ARARs are defined as chemical-, location-, or action-specific. An ARAR can be one or a combination of all three types. Each alternative is evaluated to determine how ARARs would be met.

6.1.3 Long-Term Effectiveness and Permanence

Long-term effectiveness evaluates the likelihood that the remedy would be successful and the permanence it affords. Factors TBC, as appropriate, are discussed below.

- Magnitude of residual risk/hazard remaining from untreated waste or treatment residuals remaining at the end of the remedial activities. The characteristics of the residuals are considered to the degree that they remain hazardous, taking into account their TMV and, where relevant, propensity to bioaccumulate.
- Adequacy and reliability of controls used to manage treatment residuals and untreated waste remaining at the Site. This factor includes an assessment of containment systems and institutional controls to determine if they are sufficient to ensure any exposure to human and ecological receptors is within protective levels. This factor also addresses the long-term reliability of management controls for providing continued protection from residuals, the assessment of the potential need to replace technical components of the alternative, and the potential exposure pathways and risks/hazards posed should the remedial action need replacement.

6.1.4 Reduction of Toxicity, Mobility, or Volume by Treatment

CERCLA expresses a preference for remedial alternatives employing treatment technologies that permanently or significantly reduce the TMV of hazardous substances. Each alternative is assessed for the degree to which it employs a technology to permanently and significantly reduce TMV, including how treatment is used to address the principal threats posed by the site. Factors TBC, as appropriate, include the items below.

- The treatment processes the alternatives employ and materials they would treat
- The amount of hazardous substances, pollutants, or contaminants that would be destroyed or treated, including how the principal threat(s) would be addressed
- The degree of expected reduction in TMV of the waste due to treatment
- The degree to which the treatment is irreversible
- The type and quantity of residuals that would remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate such hazardous substances and their constituents
- Whether the alternative would satisfy the statutory preference for treatment as a principal element of the remedial action

6.1.5 Short-Term Effectiveness

This criterion reviews the effects of each alternative during the construction and implementation phase of the remedial action until remedial response objectives are met. The short-term impacts of each alternative are assessed, considering the following factors, as appropriate.

- Short-term risks/hazards that might be posed to the community during implementation of an alternative
- Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures

- Potential adverse environmental impacts resulting from construction and implementation of an alternative and the reliability of the available mitigation measures during implementation in preventing or reducing the potential impacts
- Ability to provide controls to minimize potential exposures during remedial actions
- Time until protection is achieved for either the entire site or individual elements associated with specific site areas or threats

6.1.6 Implementability

The technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation is evaluated under this criterion. The ease or difficulty of implementing each alternative is assessed by considering the following factors:

Technical Feasibility

- Technical difficulties and unknowns associated with the construction and operation of a technology
- Reliability of the technology, focusing on technical problems that will lead to schedule delays
- Ease of undertaking additional remedial actions, including what, if any, future remedial actions would be needed and the difficulty to implement additional remedial actions

Administrative Feasibility

- Activities needed to coordinate with other offices and agencies and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions)

Availability of Services and Materials

- Availability of adequate off-site treatment, storage capacity, and disposal capacity and services
- Availability of necessary equipment and specialists and provisions to ensure any necessary additional resources

6.1.7 Cost

Detailed cost estimates for each alternative were developed for the FS according to A Guide to Developing and Documenting Cost Estimates during the Feasibility Study (USEPA, 2000), with an expected accuracy of -30 to +50 percent. Costs are based on published unit rates, such as R.S. Means, recent actual cost data and supplier quotes for other projects of a similar nature, and professional judgement. A contingency of 25 percent is added to the cost estimates to account for possible variations in scope and quantities. Detailed cost estimates for the alternatives are included in Appendix B and include the following:

- Capital costs
- Annual O&M costs
- Periodic costs
- Present value of capital and annual O&M costs, based on a 7 percent annual discount rate for future costs

6.1.8 State (Support Agency) Acceptance

State (support agency) acceptance is a modifying criterion under the NCP. State acceptance is assessed by USEPA following public comment on the Proposed Plan, and thus, state acceptance is not considered in the detailed analysis of alternatives presented in the FS.

6.1.9 Community Acceptance

Community acceptance is also a modifying criterion under the NCP. Assessment of community acceptance will include responses to questions that any interested person in the community may have regarding any component of the remedial alternatives presented in the Proposed Plan. This assessment will be completed by USEPA after receipt of public comments on the Proposed Plan during the public comment period, and thus, community acceptance is not considered in the detailed analysis of alternatives presented in the FS.

6.2 Individual Analysis of Alternatives

This section provides the detailed analysis for each remedial alternative developed in Section 5 and is summarized in Table 6-1. Detailed cost estimates were generated for each alternative and are summarized in Table 6-2, and projected durations of each of the alternatives are provided in Table 6-3. The cost estimates encompass the capital, construction, and long-term maintenance costs incurred over the life of the remedy (30 years) expressed as the net present value of these costs. Capital costs are based on Year 2020 dollars. Present worth assumes that construction would begin in 2022 and assumes a 7 percent discount rate. Detailed estimated cost tables are included in Appendix B.

6.2.1 Wastes

6.2.1.1 Waste Alternative 1 – No Action

Overall Protection of Human Health and the Environment

The No Action alternative would not provide protection of human health and the environment since no action would be taken to remove the containerized waste and LNAPLs in USTs and Building #15A. This alternative would not meet the RAOs.

Compliance with ARARs

This alternative would not comply with New Jersey UST regulations.

Long-Term Effectiveness and Permanence

The No Action alternative does not provide long-term effectiveness and permanence since the contaminated wastes would not be addressed. There would be no change to the magnitude of potential impacts since no action would be taken to reduce or remove the materials. The No Action alternative provides no controls of the materials nor any measures to control potential human health risks/hazards and ecological risks. The No Action alternative would not provide any mechanism to monitor the potential release of the materials.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative. There is no provision in this alternative to remove waste.

Short-Term Effectiveness

Since no remedial action would be implemented, this alternative would not pose a short-term impact to on-site workers or the local community.

Implementability

An evaluation of the implementability of the No Action Alternative is not applicable, as no action is taken.

Cost

The No Action Alternative has no capital costs over the 30-year project life. No 5-Year Review process or report is required for a No Action Alternative, so the net present value of $0 as listed in Appendix B.

6.2.1.2 Waste Alternative 2 – Removal and Off-Site Disposal

This alternative includes the removal and appropriate disposal of liquid and solid waste from containers and LNAPL in Building #15A and the USTs, as well as the removal and disposal of the USTs and surrounding NAPL-impacted soil/fill on Lot 64. Refer to Soil/Fill Alternatives for removal of NAPL-impacted soil/fill on Lot 63 not associated with USTs.

Overall Protection of Human Health and the Environment

This alternative would provide protection of human health and the environment, as the wastes (and principal threat waste) would be removed from the Site, thereby eliminating the potential for exposure of human and ecological receptors and release of the materials to environmental media. NAPL-impacted soil/fill not immediately adjacent to the USTs on Lot 63 is not addressed by this alternative.

Compliance with ARARs

This alternative would comply with New Jersey UST and LNAPL regulations. Location- and action-specific ARARs would be met by following appropriate health and safety requirements and complying with necessary regulations and permits, including disposal of removed wastes at an authorized off-site TSD facility. This alternative would meet chemical-specific ARARs by delineating LNAPL-impacted soil/fill associated with the UST closure on Lot 64 based on the NJDEP EPH ARAR and removing the impacted soil/fill from the Site.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness and permanence by removal of the waste (and principal threat waste) on Lot 64. The magnitude of the residual risks/hazards of the waste would be minimal. No wastes requiring continuing controls would remain. LNAPL-impacted soil/fill not immediately adjacent to the USTs on Lot 63 is addressed by the soil/fill alternatives.

Reduction of TMV through Treatment

This alternative would reduce the mobility of the waste, including NAPL-impacted soil/fills immediately adjacent to the USTs on Lot 64, through removal and appropriate off-Site disposal. As required by the disposal facility, the toxicity and volume may be reduced if material is treated to comply with disposal requirements. LNAPL-impacted soil/fill not immediately adjacent to the USTs on Lot 63 is addressed by the soil/fill alternatives.

Short-Term Effectiveness

This alternative would involve approximately 1 to 2 months of on-site construction operations, which would increase local traffic due to the commute of construction workers, transportation of construction equipment, shipment of waste containers, and importing of backfill materials. This alternative would have a short impact to business operation. Protection of the workers and the surrounding environment and community during implementation of this remedy can be achieved by adhering to Occupational Safety and Health Administration (OSHA) standards for construction and hazardous waste work.

Implementability

Removal of the wastes and USTs is readily implementable, as equipment and experienced vendors for this type of work are available along with backfill material and disposal facilities; however, work would be restricted to a UST-certified contractor for the UST removal. All waste would need to be characterized and treated prior to disposal. The presence of subsurface utilities would need to be assessed prior to UST removal. Excavation to remove the USTs and NAPL-impacted soil/fill associated with the USTs on Lot 64 is anticipated to extend 13 feet bgs; groundwater in the excavation area will need to be managed during UST removal and saturated soil/fill would need to be dewatered prior to disposal.

Cost

The capital cost for this alternative is $1,798,211. There are no annual O&M costs for this alternative. The present worth cost of this alternative is $1,580,700 for 30 years.

6.2.2 Soil/Fill

6.2.2.1 Soil/Fill Alternative 1 – No Action

Overall Protection of Human Health and the Environment

The No Action alternative would not provide protection of human health and the environment since no action would be taken to reduce contaminant mass and to restore the impacted areas. Potential risks/hazards to workers, visitors, and trespassers, as identified in the BHHRA, would remain. This alternative would not address the RAOs.

Compliance with ARARs

This alternative would not comply with chemical-specific ARARs, as no action would be taken to address soil/fills with COC concentrations above relevant standards.

Long-Term Effectiveness and Permanence

The No Action alternative does not provide long-term effectiveness and permanence since the contaminated soil/fill, including NAPL-impacted soil/fill where present, would not be addressed. There would be no change to the magnitude of residual contamination since no action would be taken to reduce or remove the contaminants. The No Action alternative provides no controls nor any measures to control potential human health risks/hazards and ecological risks associated with the impacted soil/fill, and would not provide any mechanism to monitor the potential migration of the impacted soil/fill.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative. There is no provision in this alternative to address impacted soil/fill. However, natural biological, chemical, and physical processes may gradually reduce concentrations of certain COCs, although not as quickly as a treatment option.

Short-Term Effectiveness

Since no remedial action would be implemented, this alternative would not pose a short-term impact to on-site workers or the local community.

Implementability

An evaluation of the implementability of the No Action Alternative is not applicable, as no action is taken.

Cost

The No Action Alternative has no capital costs over the 30-year project life. No 5-Year Review process or report is required for a No Action Alternative, so the net present value of $0 as listed in Appendix B.

6.2.2.2 Soil/Fill Alternative 2 – Institutional Controls and NAPL Removal

For this alternative, deed notices would be recorded on all 15 lots. Existing deed notices would be revised to reflect RI results and implemented engineering controls for applicable lots. Fencing would be maintained and enhanced, as appropriate, in order to limit unauthorized access to the area and prohibit future use of the area in a manner which may expose human receptors to unacceptable risks/hazards. Other institutional controls include existing zoning and local ordinances associated with use of the Site which would also be reviewed and modified, as appropriate, to ensure compliance with the objectives of this alternative. NAPL-impacted soil/fill on Lot 63 (not associated with the USTs) would be removed as part of this alternative (UST-associated NAPL-impacted soil/fill on Lot 64 is addressed by the waste alternatives).

Overall Protection of Human Health and the Environment

While NAPL-impacted soils on Lot 63 (which is a principal threat waste) would be removed, Soil/Fill Alternative 2 would not provide protection of human health and the environment for the other contaminants in the soil/fill because no engineering controls or active remedy would occur to prevent exposure. Recording and maintenance of deed notices, zoning ordinances, and access restrictions, as described in Section 5.2.2, including fencing, would not be protective of human health or the environment because exposure pathways remain. Soil/Fill Alternative 2 would not prevent or minimize potential off-site transport of soil/fill containing COCs or the potential leaching of COCs to groundwater and surface water. Removal of NAPL-impacted soil/fill on Lot 63 will eliminate the potential for exposure of human and ecological receptors to these materials.

Compliance with ARARs

This alternative would not comply with chemical-specific ARARs, as no action would be taken to address soil/fill with COC concentrations above relevant standards.

Long-Term Effectiveness and Permanence

Removal of NAPL-impacted soil/fill on Lot 63 will effectively and permanently eliminate the potential for exposure of human and ecological receptors to these materials. However, this alternative provides no controls nor any measures to control potential and ecological risks associated with COCs in soil/fill and would not provide any mechanism to monitor the potential migration of the COPCs in soil/fill. There would be no change to the magnitude of residual contamination because no engineering controls or active remedy would occur to provide long-term effectiveness or permanence. Deed restrictions would prevent unauthorized land use and development by future owners of the property in a manner inconsistent with use assumptions of the BHHRA. Fencing would reduce unauthorized on-site activities and human exposure to COPCs in soil and fill material. Regular site inspections would be performed by the responsible parties to ensure compliance with institutional controls and verify inspection of fencing.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative. There is no provision in this alternative to address COCs in soil/fill beyond the removal of NAPL-impacted soil/fill on Lot 63 adjacent to Building #7. However, natural biological, chemical, and physical processes may gradually reduce concentrations of certain COCs, although not as quickly as an active treatment option. This alternative would reduce the mobility of the NAPL-impacted soil/fills adjacent to Building #7 on Lot 63, through removal and appropriate off-Site disposal. As required by the disposal facility, the toxicity and volume may be reduced if material is treated to comply with disposal requirements.

Short-Term Effectiveness

This alternative would pose limited short-term impact to on-site workers or the local community, as on-site remedial activities would be limited to fencing installation and NAPL removal on Lot 63 adjacent to Building #7 with an on-site construction time of 1 to 2 months.

Implementability

This alternative (which includes institutional controls and barrier fencing) would be easily implemented. Removal of the NAPL-impacted soil is readily implementable, as equipment and experienced vendors for this type of work are available along with backfill material and disposal facilities. Regular site inspections would be performed by the responsible parties to ensure compliance with institutional controls and verify inspection of fencing.

Cost

The capital cost for this alternative is $303,322. The annual O&M cost, which is primarily related to performance of routine site inspections and five-year reviews, is $8,125. The present worth cost of this alternative is $356,100 for 30 years.

6.2.2.3 Soil/Fill Alternative 3 – Institutional Controls, Engineering Controls (containment and bulkhead), and NAPL Removal

Alternative 3 combines the institutional controls and NAPL removal from Alternative 2 with engineering controls (cover system) to contain COCs, including lead. In addition, the bulkhead would be reinforced or reconstructed, as appropriate, in order to minimize the potential for interaction between the Site and surface water from soil erosion (Figure 5-2). Capping of contaminated areas consists of the construction of a barrier over/around the contaminated areas. The cap is intended to prevent access to and contact with the contaminated media and/or to control its migration. Impermeable caps like asphalt caps also address the soil-to-groundwater pathway by reducing vertical infiltration.

Overall Protection of Human Health and the Environment

Through the recording and maintenance of deed notices and access restrictions, as described in Section 5.2.2, fencing and the installation of a surface cap and enhancement of the existing bulkhead along the river, this alternative would be protective of human health and the environment. Removal of NAPL-impacted soil/fill on Lot 63 will eliminate the potential for exposure of human and ecological receptors to these materials. These actions would address human exposure and ecological pathways to COCs and COECs, minimize the potential for interaction between the Site and the surface water, and reduce the potential for leaching of COCs to groundwater and surface water.

Compliance with ARARs

This alternative would meet PRGs (chemical-specific ARARs) because contaminated soil/fill exceeding PRGs would be capped. This alternative would be in compliance with required remedial action related to historic fill pursuant to N.J.A.C. 7:26E-5.4 and to N.J.A.C. 7:26C-7 since institutional controls and engineering controls are being implemented. Location- and action-specific ARARs would be met by following appropriate health and safety requirements and complying with applicable provisions of regulations and permits, including erosion and sedimentation regulations and storm water management. Institutional controls would need to be implemented and monitored.

Long-Term Effectiveness and Permanence

Deed restrictions, fencing, and appropriate risk management practices would effectively prevent unauthorized activities and development by future owners of the property in a manner inconsistent with use assumptions of the BHHRA, and the asphalt cap would effectively reduce human and ecological exposures. Removal of NAPL-impacted soil/fill on Lot 63 will effectively and permanently eliminate the potential for exposure of human and ecological receptors to these materials. The bulkhead enhancements would reduce off-site soil/fill movement. Inactive wall pipes would be sealed, eliminating this potential pathway. Some lots have existing asphalt caps via deed notices or concrete/asphalt pavement that could provide comparable long-term effectiveness and permanence as a new cap. During remedial design, these existing features will be assessed. Regular site inspections would be performed by the responsible parties to ensure compliance with institutional controls and verify inspection of fencing. Regular inspections and as-needed maintenance of the cap and enhanced bulkhead would be required to ensure those controls continue to be protective.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative, as there is no provision in this alternative to directly address COCs in soil/fill, beyond the removal of NAPL-impacted soil/fill on Lot 63 adjacent to Building #7. However, natural biological, chemical, and physical processes may gradually reduce concentrations of certain COCs. Mobility of soil/fill COCs would be reduced through installation of the cap and bulkhead enhancement. This alternative would reduce the mobility of the NAPL-impacted soil/fills adjacent to Building #7 on Lot 63, through removal and appropriate off-Site disposal. As required by the disposal facility, the toxicity and volume may be reduced if material is treated to comply with disposal requirements.

Short-Term Effectiveness

This alternative would involve on-site construction operations of 6-10 months, which would increase local traffic due to the commute of construction workers, transportation of large construction equipment, and importing of materials. Construction would generate noise during the day, particularly with respect to installation of the steel bulkhead sections. Bulkhead enhancement and capping of soil/fill at the Site will require coordination with existing operations on certain lots.

Implementability

This alternative is implementable. Equipment and experienced contractors for cap installation are readily available. Construction of the cap would require coordination with existing businesses and anticipated redevelopment plans, if available at the time of remedial design. For the bulkhead enhancement, administrative coordination with the U.S. Army Corps of Engineers, NJDEP, and USEPA would be required, and the limited space between the shoreline and existing Site buildings may present a technical challenge, so a water-side operation may be required to install the bulkhead using sheet piling. A geotechnical investigation during design of bulkhead enhancement would likely be required. The northern portion of the Site is congested with ongoing business activities and also provides the only vehicle access point. This alternative will cause disturbances to current businesses. Regular site inspections would be performed by the responsible parties to ensure compliance with institutional controls and verify inspection of fencing and maintain cap and bulkhead.

A specialty contractor would be required for installation of the enhanced bulkhead sections, using either land-based or water-based equipment. Regular inspections would be required to verify continued integrity of the fencing and to verify integrity of the cap and bulkhead. Inspection and maintenance of the bulkhead, in particular, may be challenging. Coordination with implementation of remedial action currently being designed for the Lower 8.3 Miles of the Lower Passaic River may be required.

Cost

The capital cost for this alternative is $11,140,405. The annual O&M cost, which is primarily related to performance of routine site inspections and five-year reviews, is $75,000. The present worth cost of this alternative is $10,450,900 for 30 years.

6.2.2.4 Soil/Fill Alternative 4 – Institutional Controls, Engineering Controls (containment and bulkhead), Focused Removal with Off-Site Disposal of Lead, and NAPL Removal

Alternative 4 combines the institutional controls, engineering controls (capping with bulkhead replacement), and NAPL removal from Alternative 3 with a focused excavation and off-site disposal for lead-impacted soil/fill in the vicinity of Building #7 (Figure 5-3). Other metals and COCs that are co-located with lead would also be removed. Remedial design sampling will refine excavation areas and depths. The excavated areas would be backfilled with fill material that has contaminant concentrations less than the PRGs; selected considering NJDEP “Fill Material Guidance for SRP Sites” dated April 2015; and include appropriate erosion and surface drainage controls.

Overall Protection of Human Health and the Environment

This alternative would be protective of human health and the environment through the implementation of institutional controls, engineering controls (capping of soils/fill), focused removal and NAPL-impacted soil/fill, and bulkhead improvements. These activities will prevent potential off-site transport of soil/fill containing COCs and reduce the exposure pathways to human and ecological receptors associated with soil/fill with COCs and COECs. Removal of NAPL-impacted soil/fill will eliminate the potential for exposure of human and ecological receptors to these materials.

Compliance with ARARs

By removal and appropriate off-site disposal of soil/fill exceeding the established PRGs, this alternative would comply with chemical-specific ARARs in soil/fill around Building #7 and NAPL ARARs. Safety concerns related to excavation adjacent to a building will result in offset excavation from building foundation, resulting in soil/fill designated for removal to remain in place.

Location- and action-specific ARARs would be met by following appropriate health and safety requirements and complying with applicable provisions of regulations and permits, including erosion and sedimentation regulations and storm water management. This alternative would be in compliance with required remedial action related to historic fill pursuant to N.J.A.C. 7:26E-5.4 and to N.J.A.C. 7:26C-7 since institutional controls and engineering controls are being implemented. Institutional controls would need to be implemented and monitored.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness and permanence by targeted removal of soil/fill containing lead around Building #7 and NAPLs on Lot 63. The residual risk/hazard is reduced but remains as soil/fill with other COCs above PRGs. Regular site inspections would be performed by the responsible parties to ensure compliance with institutional controls and verify inspection of fencing and maintain cap and bulkhead.

Reduction of TMV through Treatment

This alternative would reduce the mobility of the lead around Building #7 and NAPL on Lot 63 in soil/fill through removal and appropriate off-site disposal, most likely by landfilling. As required by the disposal facility, the toxicity and volume may be reduced if material is treated to comply with disposal requirements.

Short-Term Effectiveness

This alternative would involve on-site construction operations of 8 to 12 months, which would increase local traffic due to the commute of construction workers, transportation of construction equipment, shipment of waste containers, and importing of backfill materials. Protection of the workers and the surrounding environment and community during excavation of impacted soil/fill can be achieved by adhering to OSHA standards for construction and hazardous waste work, including air monitoring and dust control measures.

Implementability

Soil/fill excavation, loading, and hauling are readily implemented with common earthmoving equipment, and other requisite services, including backfill material and disposal facilities, are anticipated to be readily available. The ability to conduct deeper excavations may be limited by the proximity to building foundations, but will be assessed during the remedial design. Remedial activities would be coordinated with ongoing commercial activities at the Site. Excavation and associated soil/fill management would disrupt existing business. The northern portion of the Site is congested with ongoing business activities and also provides the only vehicle access point. This alternative will cause disturbances to current businesses. Implementability issues associated with bulkhead construction are described in Section 6.2.2.3. Regular site inspections would be performed by the responsible parties to ensure compliance with institutional controls and verify inspection of fencing and maintain cap and bulkhead.

Cost

The capital cost for this alternative is $13,623,160. The annual O&M cost, which is primarily related to performance of routine site inspections and five-year reviews, is $75,000. The present worth cost of this alternative is $12,633,300 for 30 years.

6.2.2.5 Soil/Fill Alternative 5 – Institutional Controls, In-Situ Remediation, Engineering Controls (bulkhead), and NAPL Removal

Alternative 5 combines the institutional controls, engineering controls (capping with bulkhead replacement), and NAPL removal from Alternative 3 with in-situ treatment to address lead, along with other contaminants. The footprint of this alternative is 3.62 acres but will be delineated during the remedial design. Because of the mixture of inorganic and organic contaminants on Site, an in-situ stabilization/solidification technology is assumed for costing (instead of an in-situ treatment technology). After completion of stabilization activities, the treated areas would be capped as described under Soil/Fill Alternative 3. Untreated areas of Lots 67 and 69 would be capped also (Figure 5-4).

Overall Protection of Human Health and the Environment

This alternative would be protective of human health and the environment. The exposure pathways to human and ecological receptors would be eliminated by capping and treatment of soil/fill with COCs exceeding the PRGs from the

Site. Potential transport of COCs in soil/fill off-Site and potential leaching of COCs to groundwater and surface water would also be reduced by capping and bulkhead improvements. To prevent uncontrolled release of injection fluids into the river, injection into soil/fill along the river may not be a viable option.

Compliance with ARARs

By treatment of COCs in soil/fill exceeding the established PRGs, this alternative would comply with some chemical-specific ARARs for COCs in soil/fill. Areas capped under this alternative would meet PRGs (chemical-specific ARARs).

Location- and action-specific ARARs would be met by following appropriate health and safety requirements and complying with applicable provisions of regulations and permits, including erosion and sedimentation regulations and storm water management. This alternative would be in compliance with required remedial action related to historic fill pursuant to N.J.A.C. 7:26E-5.4 and to N.J.A.C. 7:26C-7 since institutional controls and engineering controls are being implemented. Institutional controls would need to be implemented and monitored.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness and permanence by treatment of the COCs in soil/fill to immobilize COCs. The magnitude of the residual risk/hazard would be minimal, although COCs would remain in soil/fills. Regular site inspections would be performed by the responsible parties to ensure compliance with institutional controls and verify inspection of fencing and maintain cap and bulkhead.

Reduction of TMV through Treatment

This alternative would reduce the mobility of the COCs; however, the toxicity and volume of COCs would not be affected and remain on-site. This alternative would reduce the mobility of the NAPL-impacted soil/fills adjacent to Building #7 on Lot 63, through removal and appropriate off-Site disposal. As required by the disposal facility, the toxicity and volume may be reduced if material is treated to comply with disposal requirements.

Short-Term Effectiveness

This alternative would involve initial on-site construction operations of 8 to 12 months, which would increase local traffic due to the commute of construction workers, transportation of construction equipment, importing of treatment reagents, and hauling of excess soil/fill. Protection of the workers and the surrounding environment and community during treatment of impacted soil/fill can be achieved by adhering to OSHA standards for construction and hazardous waste work, including handling of treatment reagents, air monitoring and dust control measures.

Implementability

This alternative is implementable but challenging, requiring owner/tenant cooperation. Equipment, reagents, and experienced vendors for in-situ stabilization and treatment of impacted soil/fill are commercially available. Pilot studies would be required during remedial design to determine the appropriate reagents and mixing ratios to meet PRGs and required leachability treatment criteria. Remedial activities would be coordinated with ongoing commercial activities at the Site. The northern portion of the Site is extremely congested with ongoing business activities and also provides the only vehicle access point. Treatment in the northern portion will cause significant disturbances to businesses, as reagent delivery to the subsurface will require the use of either large diameter augers, which may not be feasible due to underground utilities, or closely spaced injection points, due to the relatively shallow depth of impacts. Implementability issues associated with bulkhead construction are described in Section 6.2.2.3. Regular site inspections would be performed by the responsible parties to ensure compliance with institutional controls and verify inspection of fencing and maintain cap and bulkhead.

Cost

The capital cost for this alternative is $15,222,505. The annual O&M cost, which is primarily related to performance of routine site inspections and five-year reviews, is $68,750. The present worth cost of this alternative is $13,971,400 for 30 years.

6.2.3 Groundwater

6.2.3.1 Groundwater Alternative 1 – No Action

Overall Protection of Human Health and the Environment

The No Action alternative would not provide protection of human health and the environment since no action would be taken to prevent exposure to groundwater at the Site or to prevent or minimize potential discharge to surface water, although at the present time there are no users of groundwater. This alternative would not address the RAOs. Natural processes such as dispersion and degradation may gradually reduce COC concentrations in the aqueous phase; however, no monitoring would be performed to confirm this reduction.

Compliance with ARARs

This alternative would not comply with chemical-specific ARARs, as no action would be taken to address groundwater with COC concentrations above relevant standards.

Long-Term Effectiveness and Permanence

The No Action alternative does not provide long-term effectiveness and permanence since COCs in groundwater would not be addressed. There would be no change to the magnitude of residual contamination since no action would be taken to reduce or remove the contaminants. The No Action alternative provides no controls nor any measures to control potential human health risks/hazards and ecological risks associated with the impacted groundwater and would not provide any mechanism to monitor its potential migration.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative. There is no provision in this alternative to address impacted groundwater. However, natural biological, chemical, and physical processes may continue to gradually reduce concentrations of certain COCs, although not as quickly as a treatment option.

Short-Term Effectiveness

Since no remedial action would be implemented, this alternative would not pose a short-term impact to on-site workers or the local community.

Implementability

An evaluation of the implementability of the No Action alternative is not applicable, as no action is taken.

Cost

The No Action Alternative has no capital costs over the 30-year project life. No 5-Year Review process or report is required for a No Action Alternative, so the net present value of $0 as listed in Appendix B.

6.2.3.2 Groundwater Alternative 2 – Institutional Controls, Site Containment at River Edge, and Pump and Treat

This alternative combines the designation of CEAs and WRAs for the entire Site, installation of a vertical barrier along the river edge to reduce the potential for interaction between groundwater and the river, and the installation of an extraction and treatment system for shallow and deep groundwater. Ongoing groundwater monitoring would be performed to demonstrate that the selected remedy continues to be protective of human health and the environment.

Overall Protection of Human Health and the Environment

Through the maintenance of existing CEAs and WRAs at the Site and designation of additional CEAs and WRAs for the remainder of the Site, this alternative would prevent exposure to COCs in groundwater, and the extraction and treatment system may reduce concentrations of COCs in groundwater over time, although the timeframe for such reduction is indefinite, particularly with respect to metals. Additionally, installation of the vertical barrier would reduce the discharge of groundwater containing COCs to surface water.

Compliance with ARARs

By providing institutional controls restricting the use of groundwater and thereby eliminating the exposure pathway, compliance with action-specific ARARs may be achieved. In the short-term, this alternative would not comply with chemical-specific ARARs (PRGs) associated with the restoration of groundwater, however, over time, the extraction of impacted groundwater may eventually reduce COC concentrations to meet certain chemical-specific ARARs; however, on-going dissolution of residual COC in the soil/fill will be a continual source that needs to be treated. The timeframe for achieving compliance with these ARARs has not been estimated at this time. Other alternatives, including waste removal and capping or excavation of contaminated soil/fill, will reduce potential COC infiltration into groundwater from unsaturated soil/fill. Groundwater would be monitored until PRGs for COCs are met.

Long-Term Effectiveness and Permanence

If complied with, groundwater use restrictions in combination with the existing reliable supply of public water available throughout the area would effectively prevent unacceptable human exposure to COCs in groundwater, and the barrier wall would effectively reduce the potential for interaction between site groundwater and the river. It is likely that the use restrictions would be required to remain in effect for an indefinite period. Groundwater monitoring would be performed until PRGs are met. Regular site inspections would be performed by the responsible parties to ensure compliance with institutional controls, to verify integrity of vertical barrier and pump and treat system, and to perform operation and maintenance with groundwater sampling.

Reduction of TMV through Treatment

Installation and operation of a groundwater extraction and treatment system would effectively reduce the TMV of COCs captured by the extraction system.

Short-Term Effectiveness

The implementation of this alternative would entail limited risk/hazard of human exposure to COCs in groundwater, with the greatest contribution to this risk/hazard resulting from the installation of extraction wells and O&M of the extraction and treatment system with an on-site construction time of 12 to 18 months . Risks/hazards would also be associated with use of heavy equipment and handling of sheet piles for installation of the vertical barrier wall along the river. Such risks/hazards would be minimized by following appropriate health and safety requirements.

Implementability

This alternative is implementable, as certain lots/areas already have the indicated institutional controls, and services and equipment are readily available for installation of the extraction and treatment system, as well as the vertical barrier wall along the river. For the treatment system, a portion of the Site would have to be designated for construction of a significantly sized treatment building (at least 5,000 SF, and more likely 7,500 SF), limiting the future use of that portion of the Site. Installation of conveyance lines between the extraction wells and the treatment system may also be challenging given the presence of underground utilities throughout the Site. Installation of the barrier wall may need to be coordinated with implementation of remedial action currently being designed for the lower 8.3 miles of the Lower Passaic River. Regular inspections would be performed to verify compliance with the CEAs and WRAs, and routine groundwater monitoring would be performed. Moderate disruption to the industrial park's businesses would occur during vertical barrier wall installation. Installation and operation of an extraction and treatment system will be moderate during construction and low during treatment operations.

Cost

The capital cost for this alternative is $30,590,844. The annual O&M cost, which is primarily related to O&M of the extraction and treatment system, is $1,125,000. The present worth cost of this alternative is $34,258,600 for 30 years.

6.2.3.3 Groundwater Alternative 3 – Institutional Controls and In-Situ Remediation

Alternative 3 includes the CEA and WRA components described for Groundwater Alternative 2. A focused in-situ remediation of potential source area(s) (i.e., UST area) in combination with MNA (Groundwater Alternative 7) are other components of this alternative. The most appropriate in-situ treatment approach/reagent(s) will be selected as part of the remedial design, which will consider performance of treatability and/or pilot studies and evaluation of tidal influences on reagent delivery. Based on RI findings, LNAPL has not been observed in groundwater wells, and thus, remedial measures are not warranted at this time. If LNAPL is observed in groundwater (outside of the UST area), this alternative would include remedial measures to address the LNAPL, depending on the nature and extent of the LNAPL, and could include excavation and removal, passive absorption, or dual-phase extraction, among other potential approaches.

Overall Protection of Human Health and the Environment

Through the maintenance of existing CEAs and WRAs at the Site, designation of additional CEAs and WRAs for the remainder of the Site, and in-situ treatment of organics and inorganics, this alternative would prevent exposure to COCs and may reduce potential discharge of groundwater with COCs to surface water (if and when PRGs are attained).

Compliance with ARARs

By providing institutional controls restricting the use of groundwater and thereby eliminating the exposure pathway, along with treatment to reduce the migration of COCs in groundwater, compliance with action-specific ARARs may be achieved with multiple treatments. Over time, the process option may eventually reduce COC concentrations to meet certain chemical-specific ARARs; however, on-going dissolution of residual COC in the soil/fill will be a continual source to groundwater that will need to be treated.

Other alternatives, including waste removal, capping, or excavation of contaminated soil/fill, may reduce lead infiltration into groundwater from unsaturated soil/fill. Groundwater would be monitored until PRGs for COCs are met.

Long-Term Effectiveness and Permanence

If complied with, groundwater use restrictions in combination with the existing reliable supply of public water available throughout the area would effectively prevent unacceptable human exposure to impacted groundwater. As the impacted groundwater may not be remediated for all COCs by this alternative, it is possible that the use restrictions would be required to remain in effect for an indefinite period. Regular site inspections would be performed by the responsible parties to ensure compliance with institutional controls and to perform operation and maintenance with groundwater sampling.

Reduction of TMV through Treatment

Performance of in-situ remediation would reduce the TMV of certain COCs (organics) in groundwater by treatment. The mobility of other metals in groundwater would be reduced, but not the toxicity or volume.

Short-Term Effectiveness

This alternative would initially involve on-site construction operations, including injection or sparging and monitoring well installation. Follow-up injections or operation of sparging systems and regular groundwater monitoring may continue as needed to implement the remedy. If soil/fill mixing is utilized for reagent delivery, this alternative will likely take 9 to 12 months to implement the first injection, not including potential delays associated with minimizing business disruptions. Protection of the workers and the surrounding environment and community during these activities can be achieved by adhering to OSHA standards for construction and hazardous waste work. Design of an injection remedy should address the potential for loss of reagents to the river.

Implementability

Implementation of this alternative is feasible, as providers of these services are available. Operations would have to be coordinated with ongoing business operations at the Site. Implementability of an in-situ remedy may be affected by on-site hydrogeological conditions with respect to ability to deliver reagents to the aquifer or the radius of influence of injection or sparging wells, which may be limited, particularly for shallow groundwater. Tidal fluctuations would also need to be accounted for in designing the remedy. Regular inspections would be performed to verify compliance with the CEAs and WRAs, and routine groundwater monitoring would be performed. Based on current Site businesses and depending on the work areas and means of reagent delivery, disruption of businesses ranges from moderate to severe.

Cost

The capital cost for this alternative is $28,459,770, assuming in-situ chemical oxidation and stabilization. The 30-year O&M cost, which includes routine groundwater monitoring, is $131,250. The present worth cost of this alternative is $20,844,800 for 30 years. Alternate treatment methods are expected to have similar present worth costs.

6.2.3.4 Groundwater Alternative 4 – Institutional Controls, Pump and Treat, and Targeted Periodic In-Situ Remediation

This alternative combines the designation of CEAs and WRAs for the entire Site with the installation of a site-wide extraction and treatment system, and a targeted, periodic in-situ treatment approach in upgradient portions of the Site. Ongoing groundwater monitoring would be performed to demonstrate that the selected remedy continues to be protective of human health and the environment. As with Alternative 3, if LNAPL is observed in groundwater (outside of the UST area), this alternative would include remedial measures to address the LNAPL, depending on the nature and extent of the LNAPL, and could include excavation and removal, passive absorption, or dual-phase extraction, among other potential approaches.

<u>Overall Protection of Human Health and the Environment</u>

Through the maintenance of existing CEAs and WRAs at the Site and designation of additional CEAs and WRAs for the remainder of the Site, this alternative would prevent exposure to COCs in groundwater, and the in-situ treatment and extraction/treatment system may reduce concentrations of COCs in groundwater over time, although the timeframe for such reduction is indefinite, particularly with respect to metals. The extraction system along the downgradient portion of the Site would reduce the discharge of groundwater containing COCs to surface water. To prevent uncontrolled release of injection fluids into the river, injection wells along the river may not be a viable option.

<u>Compliance with ARARs</u>

By providing institutional controls restricting the use of groundwater and thereby eliminating the exposure pathway, compliance with action-specific ARARs may be achieved. In the short-term, this alternative would not comply with chemical-specific ARARs (PRGs) associated with the restoration of groundwater; however, over time, in-situ treatment and the extraction of impacted groundwater may eventually reduce COC concentrations to meet certain chemical-specific ARARs. The timeframe for achieving compliance with these ARARs has not been estimated at this time; however, on-going dissolution of residual COC in the soil/fill will be a continual source to groundwater that will need to be treated. Other alternatives, including waste removal and capping or excavation of contaminated soil/fill, will reduce potential COC infiltration into groundwater from unsaturated soil/fill. Groundwater would be monitored until PRGs for COCs are met.

Long-Term Effectiveness and Permanence

If complied with, groundwater use restrictions in combination with the existing reliable supply of public water available throughout the area would effectively prevent unacceptable human exposure to COCs in groundwater, and extraction wells along the river would reduce discharge of Site groundwater to the river. As demonstrated by the tidal influences along the river, river water will be captured by the extraction wells, but induced infiltration can be managed with effective monitoring of groundwater levels, pumping levels, river stage, and a variable pumping rate SCADA controlled system. Excessive capture and treatment of river water is not cost effective, nor is it an environmentally sustainable practice. As such, the design and operation of the system must minimize potential induced infiltration. It is likely that the use restrictions would be required to remain in effect for an indefinite period. Groundwater monitoring would be performed until PRGs are met. Regular site inspections would be performed by the responsible parties to ensure compliance with institutional controls and to perform operation and maintenance with groundwater sampling.

Reduction of TMV through Treatment

Installation and operation of a groundwater extraction and treatment system would effectively reduce the TMV of COCs captured by the extraction system. In upgradient portions of the Site where periodic, targeted in-situ remediation is performed, it would reduce TMV of organic COCs, but would only reduce the mobility of inorganic COCs.

Short-Term Effectiveness

The implementation of this alternative would entail moderate risk/hazard of human exposure to COCs in groundwater, with the greatest contribution to this risk/hazard resulting from the handling of treatment reagents and operation of equipment needed for reagent delivery to the subsurface, along with the installation of extraction wells and O&M of the extraction and treatment system. Such risks/hazards would be minimized by following appropriate health and safety requirements. This alternative would also involve on-site construction operations, including injection and monitoring well installation. Follow-up injections and regular groundwater monitoring may continue as needed to implement the remedy. This alternative would include an on-site construction time of 8 to 10 months to implement (not including subsequent targeted injections).

Implementability

This alternative is implementable, as certain lots/areas already have the indicated institutional controls, and services and equipment are readily available for installation of the extraction and treatment system, as well as in-situ treatment. For the treatment system, a portion of the Site would have to be designated for construction of a significantly sized treatment building (at least 5,000 SF, and more likely 7,500 SF), limiting the future use of that portion of the Site. Installation of conveyance lines between the extraction wells and the treatment system may also be challenging given the presence of underground utilities throughout the Site. Implementing an in-situ treatment remedy may cause significant business disruptions in the upgradient portion of the Site. Regular inspections would be performed to verify compliance with the CEAs and WRAs, and routine groundwater monitoring would be performed.

Cost

The capital cost for this alternative is $12,831,750. The annual O&M cost, which is primarily related to O&M of the extraction and treatment system, as well as routine groundwater monitoring, is $1,500,000. The present worth cost of this alternative is $24,234,400 for 30 years. Alternate treatment methods are expected to have similar present worth costs.

6.2.4 Sewer Water

6.2.4.1 Sewer Water Alternative 1 – No Action

Overall Protection of Human Health and the Environment

The No Action alternative would not provide protection of human health and the environment since no action would be taken to remove impacted water and solids from Manhole 8 and associated piping. This alternative would not meet the RAOs.

Compliance with ARARs

This alternative would not comply with chemical-specific ARARs.

Long-Term Effectiveness and Permanence

The No Action alternative does not provide long-term effectiveness and permanence since the water and solids in the sewer would not be addressed. There would be no change to the magnitude of potential impacts since no action would be taken to reduce or remove the materials. The No Action alternative provides no controls of the materials nor any measures to control potential human health risks/hazards. The No Action alternative would not provide any mechanism to monitor the potential release of the materials.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative. There is no provision in this alternative to remove the sewer materials.

Short-Term Effectiveness

Since no remedial action would be implemented, this alternative would not pose a short-term impact to on-site workers or the local community.

Implementability

An evaluation of the implementability of the No Action Alternative is not applicable, as no action is taken.

Cost

The No Action Alternative has no capital costs over the 30-year project life. No 5-Year Review process or report is required for a No Action Alternative, so the net present value of $0 as listed in Appendix B.

6.2.4.2 Sewer Water Alternative 2 – Removal and Off-Site Disposal

This alternative consists of the transfer of the sewer water and associated solids into appropriate containers or transport vehicles for off-site treatment and/or disposal.

Overall Protection of Human Health and the Environment

This alternative would provide protection of human health and the environment, as the sewer materials would be removed from the Site, thereby eliminating the potential exposure to the waste, release of the materials to the environment, or potential discharge of sewer water COCs to surface water.

Compliance with ARARs

This alternative would comply with ARARs. Location- and action-specific ARARs would be met by following appropriate health and safety requirements and complying with applicable provisions of regulations and permits, including disposal of removed materials at an authorized off-site TSD facility. This alternative would meet chemical-specific ARARs for sewer water.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness and permanence by removal of the sewer material and filling of the manhole and associated line. The magnitude of the residual risk/hazard would be minimal, and no material (aqueous or solid) requiring continuing controls would remain.

Reduction of TMV through Treatment

This alternative would reduce the mobility of the sewer material through removal and appropriate off-Site disposal. As required by the disposal facility, the toxicity and volume may be reduced if material is treated to comply with disposal requirements.

Short-Term Effectiveness

This alternative would involve approximately 1 months of on-site construction operations, which would increase for a short duration the local traffic due to the commute of construction workers and transportation of construction equipment. This alternative would have a short impact to business operation. Protection of the workers and the surrounding environment and community during removal and filling can be achieved by adhering to OSHA standards for construction and hazardous waste work.

Implementability

Removal of the sewer materials and filling of the manhole and piping is readily implementable, as equipment and experienced vendors for this type of work are available; however, a specialized sewer contractor may be required. Solids removed from the sewer may need to be dewatered prior to disposal. Sewer water and solids would need to be characterized and treated as warranted prior to disposal.

Cost

The capital cost for this alternative is $27,981. There is no annual O&M cost for this alternative. The present worth cost of this alternative is $24,900 for 30 years.

6.2.5 Soil Gas

6.2.5.1 Soil Gas Alternative 1 – No Action

Overall Protection of Human Health and the Environment

The No Action alternative would not provide protection of human health since no action would be taken to prevent COCs in soil gas from migrating to indoor air in existing buildings or future buildings to cause an unacceptable risk/hazard to future indoor workers (detected concentrations do not pose unacceptable cancer risks or noncancer hazards to current indoor workers as modeled in the BHHRA). This No Action alternative also assumes that no action would occur under the Soil/Fill Alternatives to address contaminated soil/fill. Natural processes may gradually reduce COC concentrations in soil/fill; however, no monitoring of soil/fill would be performed to confirm this reduction. Vapor intrusion does not present a potential risk to the environment.

Compliance with ARARs

This alternative would not comply with ARARs, as no action would be taken to address COCs in soil gas (assuming no action is taken under the soil/fill alternatives to address impacted soil/fill). This alternative would not comply with NJDEP VISL, as no action would be taken to address potential indoor air impacts associated with shallow groundwater within 100 feet of the building.

Long-Term Effectiveness and Permanence

The No Action alternative does not provide long-term effectiveness and permanence since COCs in soil gas would not be addressed (assuming no action is taken under the soil/fill alternatives to address impacted soil/fill). The No Action alternative provides no measures to control or monitor for the potential migration of soil gas to indoor air.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative (assuming no action is taken under the soil/fill alternatives to address impacted soil/fill). There is no provision in this alternative to address soil gas. However, natural biological, chemical, and physical processes may gradually reduce concentrations of certain COCs.

Short-Term Effectiveness

Since no remedial action would be implemented, this alternative would not pose a short-term impact to on-site workers or the local community.

Implementability

An evaluation of the implementability of the No Action Alternative is not applicable, as no action is taken.

Cost

The No Action Alternative has no capital costs over the 30-year project life. No 5-Year Review process or report is required for a No Action Alternative, so the net present value of $0 as listed in Appendix B.

6.2.5.2 Soil Gas Alternative 2 – Institutional Controls, Air Monitoring or Engineering Controls (existing occupied buildings), and Site-Wide Engineering Controls (future buildings)

This alternative consists of establishing or enhancing deed notices and/or CEAs site-wide (which will address the footprint presented in Appendix A where concentrations of naphthalene, total xylene, and TCE exceed the soil gas PRG) to provide certain restrictions upon the use of the property, requiring assessing and, if necessary, addressing the potential for vapor intrusion prior to occupying existing vacant buildings or constructing new buildings on those lots. Ongoing indoor air monitoring or engineering controls (such as a SSDS) would be required in the seven existing occupied buildings to confirm previous assessment results and/or to ensure the indoor workers are protected, due to the presence of soil gas or VOCs in groundwater above NJDEP VISLs in shallow monitoring wells within 100 feet of the building. If air monitoring indicates vapor intrusion, then responsible parties would be required to implement engineering controls.

Overall Protection of Human Health and the Environment

Through the recording and maintenance of deed restrictions and CEAs on the affected lots, this alternative would be protective of human health, as it would require assessing and, if needed, mitigating vapor intrusion risks/hazards in existing buildings prior to occupancy, and establishing required protective measures for new construction. Natural processes may gradually reduce COC concentrations in soil/fill; however, no monitoring of soil/fill would be performed to confirm this reduction. On-going indoor air monitoring would also protect future indoor workers from potential vapor intrusion since appropriate action can then be taken in response to reported vapor intrusion.

Compliance with ARARs

This alternative would comply with location-specific and action-specific ARARs for addressing potential vapor intrusion. Air monitoring by itself would not address chemical-specific ARARs unless engineering controls are implemented.

Long-Term Effectiveness and Permanence

Requirements for assessing and mitigating vapor intrusion risks/hazards for existing and future buildings on the affected lots would be effective. Regular site inspections would be required by the responsible parties to conduct air monitoring and to confirm and document continued compliance with the requirements and operation of engineering controls, if installed.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative, except where active (electro-mechanical) mitigation of vapor intrusion is determined to be necessary and treatment of vapors performed.

Short-Term Effectiveness

Short-term risks/hazards for this alternative would be limited to those buildings associated with the collection of vapor samples and, if needed, installation of engineering controls. These risks/hazards are readily controlled by following appropriate health and safety practices. This alternative would include an on-site construction time of 1 to 2 months to implement.

Implementability

This alternative is implementable and requires cooperation by the responsible parties for inspections and air monitoring. If engineering controls are required for an existing building, design testing may be required. Regular inspections would be required to verify continued compliance with the requirements of this alternative. Disruption to businesses ranges from minimal to moderate.

Cost

The capital cost for this alternative is $123,525. The annual O&M cost, which is primarily related to performance of routine site inspections, is $31,500. The present worth cost of this alternative is $449,800 for 30 years.

6.2.5.3 Soil Gas Alternative 3 – Institutional Controls, Air Monitoring or Engineering Controls (future buildings), and In-Situ Remediation of Soil/Fill (existing occupied buildings)

This alternative includes the site-wide institutional controls and continued air monitoring or engineering controls for existing occupied and future buildings associated with soil gas and VOCs in groundwater above NJDEP VISLs, as described for Soil Gas Alternative 2. However, in lieu of air monitoring and engineering controls (SSDS) for existing occupied buildings, this alternative allows for in-situ remediation of 7,500 CY (see Appendix A) of soil/fill containing TCE, total xylenes, and naphthalene above the PRG (Figure 5-14) within 100 feet of those buildings.

Overall Protection of Human Health and the Environment

Through the recording and maintenance of deed restrictions and CEAs on the affected lots, this alternative would be protective of human health, as it would require assessing and, if needed, mitigating vapor intrusion risks/hazards in existing buildings prior to occupancy using in-situ treatment of soil/fill associated with potential vapor intrusion risks/hazards and establishing required protective measures for new construction elsewhere on the Site. Natural processes may gradually reduce COC concentrations in soil/fill; however, no monitoring of soil/fill would be performed to confirm this reduction. On-going indoor air monitoring would also protect future indoor workers from potential vapor intrusion since appropriate action can then be taken in response to reported vapor intrusion.

Compliance with ARARs

This alternative would comply with location-specific and action-specific ARARs for addressing potential vapor intrusion. Soil Gas Alternative 3 would also comply with chemical-specific ARARs since action would be taken to remediate the soil/fill material.

Long-Term Effectiveness and Permanence

In-Situ treatment of soil/fill presenting potential vapor intrusion risks/hazards for existing occupied buildings and implementing requirements for assessing and mitigating vapor intrusion risks/hazards for future buildings would be effective. Regular site inspections would be required by the responsible parties to conduct air monitoring and to confirm and document continued compliance with the requirements and operation of engineering controls, if installed.

Reduction of TMV through Treatment

Reductions of contaminant TMV through in-situ treatment would be achieved under this alternative for VOCs in soil/fill in the vicinity of existing occupied buildings, assuming that the selected in-situ technology destroys contaminant mass.

Short-Term Effectiveness

Short-term risks/hazards for this alternative would be limited to those buildings associated with the handling of in-situ treatment reagents; operation of equipment for reagent delivery; and the collection of vapor samples and, if needed, installation of engineering controls. These risks/hazards are readily controlled by following appropriate health and safety practices. This alternative would include an on-site construction time of 4 to 6 months to implement (including an initial round of injections).

Implementability

This alternative is implementable and requires cooperation by the responsible parties for inspection and air monitoring. For the existing buildings, treatability testing during the remedial design may be appropriate to determine the most effective treatment reagent, and multiple applications of the reagent may be necessary. Business disruption would be minimal to moderate, depending on the reagent delivery method selected.

Cost

The capital cost for this alternative is $4,591,968. There are no annual O&M costs associated with this alternative. The present worth cost of this alternative is $4,050,800 for 30 years.

6.3 Comparative Analysis of Alternatives

This comparative analysis section evaluates how each of the remedial alternatives achieves the evaluation criteria relative to one another. To compare the alternatives, ratings of poor, fair, good, or excellent (low, medium, or high for costs) were assigned to each of the evaluation criteria used in the analysis of the alternatives.

6.3.1 Waste

Waste Alternative 2 (removal and off-site disposal) rates better than Waste Alternative 1 (No Action) in terms of overall protectiveness and compliance with ARAR, which are threshold evaluation criteria. Waste Alternative 2 also rates better in terms of the balancing evaluation criteria for long-term effectiveness and reduction of TMV since action would be taken under Waste Alternative 2 to remove and dispose waste and principal threat waste on Lot 64. In terms of short-term effectiveness, implementability, and cost, Waste Alternative 1 rates better as no action is taken. Waste Alternative 2 would need to be combined with a soil/fill alternative that addresses the NAPL-impacted soil/fill not associated with the USTs on Lot 63.

6.3.2 Soil/Fill

Soil/Fill Alternative 3 (Institutional Controls, Engineering Controls, and NAPL Removal), Soil/Fill Alternative 4 (Institutional Controls, Engineering Controls, Focused Lead Removal, and NAPL Removal), and Soil/Fill Alternative 5 (Institutional Controls, Engineering Controls, In-Situ Remediation, and NAPL Removal) rate better than Soil/Fill Alternative 1 (No Action) and Soil/Fill Alternative 2 (Institutional Controls and NAPL Removal) in terms of overall protectiveness and compliance with ARAR, which are threshold evaluation criteria. Soil/Fill Alternative 1 and Soil/Fill Alternative 2 would not meet the chemical-specific ARARs and would not be protective since no engineering controls or active remediation to prevent human health or ecological exposure to residual contamination (other than removal of NAPL-impact soil on Lot 63 in Alternative 2). While Soil/Fill Alternative 3 would comply with chemical-specific ARARs through capping of soil/fill, Soil/Fill Alternative 4 would offer better compliance with the chemical-specific ARARs since lead-contaminated soil/fill around Building #7 would be removed from the Site. Stabilization/solidification methods (Soil/Fill Alternative 5) would meet chemical-specific ARARs for all contaminants, depending on the efficacy of the treatment. Location- and action-specific ARARs are met by Soil/Fill Alternatives 3 through 5. Soil/Fill Alternatives 3 through 5 rate the best for preventing off-site transport of soil/fill containing COCs by construction of a bulkhead. None of the Alternatives eliminate the need for institutional controls.

In terms of the balancing evaluation criteria for long-term effectiveness and reduction of TMV, Soil/Fill Alternative 4 rates better than the other alternatives. Soil/Fill Alternative 4 provides the best permanence due to excavation/disposal of lead-contaminated soil/fill around Building #7. In terms of TMV, Soil/Fill Alternative 4 rates the best for reducing volume and toxicity of COC on-site with the removal and off-site disposal of elevated lead around Building #7, which will also remove co-located contaminants in the excavation.

Not including the No Action alternative, Soil/Fill Alternative 2 rates best in terms of the balancing criteria for short-term effectiveness, implementability, and cost while Soil/Fill Alternative 5 rates the worst due to challenges associated with implementing the in-situ technology around the buildings and bulkhead and the greatest impacts and disruption to active business on Site. The northern portion of the Site is extremely congested with ongoing business activities and also provides the only vehicle access point. Soil/Fill Alternative 5 treatment areas in the northern portion will cause significant disturbances to businesses, as reagent delivery to the subsurface will require the use of either large diameter augers, which may not be feasible due to underground utilities, and closely spaced injection points, due to the relatively shallow depth of impacts. Soil/Fill Alternatives 2 through 5 have similar long-term O&M obligations through institutional controls.

Other than the No Action alternative, none of the soil/fill alternatives reduce these obligations to less than 30 years assumed in the FS process.

6.3.3 Groundwater

All of the groundwater alternatives will be impacted by the on-going dissolution of residual COC in the soil/fill to the groundwater, which will need to be treated. Other alternatives, including waste removal, capping, or excavation of contaminated soil/fill, may reduce residual COC infiltration into groundwater from unsaturated soil/fill.

Groundwater Alternative 4 (pump and treat with targeted periodic in-situ remediation) rates the best in terms of the threshold evaluation criteria (overall protectiveness and compliance with ARARs) and the balancing evaluation criteria of long-term effectiveness, with Groundwater Alternative 2 (contaminant at river edge and pump and treat) and, Groundwater Alternative 3 (In-Situ Remediation) rating slightly lower in these criteria largely due to their sole reliance on either pump and treat or in-situ applications as singular components, which will likely extend the timeframe to achieve the goal of groundwater restoration. Groundwater Alternative 1 (No Action) would not meet the chemical-specific ARARs since no action would be taken. Location- and action-specific ARARs are met by Groundwater Alternatives 2 through 4. While Alternatives 3 and 4 (in-situ) may face performance challenges associated with aquifer chemistry, Alternative 4 benefits from the hydraulic control and ex-situ treatment from the pump and treat system.

Not including the No Action alternative, Groundwater Alternative 4 ranks highest for implementability, while Groundwater Alternatives 2 is rated lower because of the construction of the barrier wall, and Groundwater Alternative 3 is affected by the multiple targeted rounds of in-situ injection. The implementability of Groundwater Alternatives 2 and 4 are also affected by the need to designate a portion of the property for construction of a new treatment facility. While handling of treatment reagents lowers the short-term effectiveness rating for Groundwater Alternatives 3 and 4, the in-situ technology potentially destroys VOC, SVOC, and Lead contaminant mass, resulting in better rating for these two alternatives. It should be noted that Groundwater Alternative 4 has targeted periodic injections, which will be less disruptive than Groundwater Alternative 3 with its multiple large-scale injections.

In terms of cost, Groundwater Alternative 3 and Groundwater Alternative 4 are similar with construction of the containment wall affecting the cost on Groundwater Alternative 2. Not including the No Action alternative, all of the groundwater alternatives include a long-term O&M through institutional controls and long-term groundwater monitoring, whereas Groundwater Alternatives 2 and 4 have substantial long-term costs associated with O&M of pump and treat systems. None of these five groundwater alternatives eliminate O&M obligations to less than 30 years assumed in the FS process, although it is possible that the source removal activities included in the waste and soil/fill alternatives may reduce certain O&M obligations over time.

Regarding USEPA's guidance on the use of Green and Sustainable Remediation in the CERCLA site remediation process, Groundwater Alternative 4 rates the lowest for environmental sustainability because of the potential risk that additional resources could be expended to treat river water, which is not site-related media. However, proper system controls and hydraulic management can be used to mitigate this risk.

6.3.4 Sewer Water

Sewer Alternative 2 (removal and off-site disposal) rates better than Sewer Alternative 1 (No Action) in terms of overall protectiveness and compliance with ARAR, which are threshold evaluation criteria. Sewer Alternative 2 also rates better in terms of the balancing evaluation criteria for long-term effectiveness and reduction of TMV since action would be taken under Sewer Alternative 2 to remove and dispose waste sewer material. In terms of short-term effectiveness, implementability, and cost, Sewer Alternative 1 rates better as no action is taken.

6.3.5 Soil Gas

Soil Gas Alternative 2 (Institutional Controls, Site-Wide Engineering Controls, and Monitoring/Engineering Controls) and Soil Gas Alternative 3 (Institutional Controls, Site-Wide Engineering Controls, and In-Situ Remediation) rate better than Soil Gas Alternative 1 (No Action) in terms of overall protectiveness and compliance with ARAR, which are threshold evaluation criteria. For Soil Gas Alternative 2 and Soil Gas Alternative 3, potential risks/hazards associated with soil gas are directly addressed through air monitoring and engineering controls for both existing occupied buildings and future buildings.

In terms of the balancing evaluation criteria, Soil Gas Alternative 3 rates better than Soil Gas Alternative 2 for long-term effectiveness and reduction in TMV, as this alternative would include provisions to directly address soil/fill associated with potential vapor intrusion risks/hazards at occupied buildings and the selected in-situ technology would destroy contaminant mass. However, Soil Gas Alternative 2 rates best in terms of short-term effectiveness and implementability. Soil Gas Alternative 3 is considerably higher in cost compared to Soil Gas Alternative 2; the additional cost (for implementing in-situ remediation in lieu of air monitoring or engineering controls) is not commensurate with the expected benefit to the threshold evaluation criteria of overall protectiveness and compliance with ARARs.

6.4 Cross-Media Effects

It is noted that although alternatives for each site medium were evaluated independently of alternatives for other media, the selection and implementation of specific alternatives for certain media may enhance, overlap, or otherwise render irrelevant specific alternatives or portions thereof for other media. Overlapping components of alternatives from different media may also present cost benefits, increase the effectiveness of a treatment, and reduce the duration of treatment. Specific examples of these cross-media effects include the following:

- Waste Alternative 2's removal of USTs and their contents along with directly associated NAPL-impacted soil/fill removes a potential groundwater source. This action is expected to result in improved groundwater quality with respect to VOCs and may reduce the scope/footprint and time needed to achieve certain chemical-specific ARARs, as well as increase the effectiveness of the Groundwater Alternatives with respect to organics.

- Waste Alternative 2 will remove the NAPL-impacted soil/fill associated with the USTs on Lot 64. This alternative in combination with a Soil/Fill Alternative (to address the NAPL-impacted soil/fill on Lot 63, which is not associated with UST removal), will remove the principal waste threat on the Site.

- Remedial responses associated with Soil/Fill Alternatives 3 through 5 will also affect naphthalene, total xylene, and TCE in the soil/fill, which will benefit the Soil Gas Alternatives and minimize potential vapor intrusion into existing occupied buildings or future occupied buildings. Soil/Fill Alternative 5 could effectively address the potential risks/hazards associated with soil gas migration to indoor air, thereby eliminating the need for Soil Gas Alternatives.

- Treatment or removal of contaminated soil/fill could increase the effectiveness of Groundwater Alternatives, potentially decreasing the time needed to achieve ARARs, and potentially reducing the scope of the Groundwater Alternatives. The removal of other NAPL-impacted soil/fill included in Soil/Fill Alternatives 2 through 5 may increase the effectiveness and scope of the Groundwater Alternatives with respect to organic COCs. As well, the limited soil/fill removal of Soil/Fill Alternative 4 and the in-situ remediation included in Soil/Fill Alternative 5 would be expected to have a positive impact on groundwater quality, which could also reduce the scope of groundwater remediation required.

- Implementation of access restrictions under institutional controls for the five soil/fill alternatives is expected to reduce illegal dumping. The reduction of illegal dumping reduces sources to impact soil/fill and groundwater. The elimination of this potential source to groundwater could reduce the time needed to achieve groundwater RAOs under Groundwater Alternatives 2 through 4, particularly with respect to organic COCs.

- Capping of the Site under Soil/Fill Alternatives 3 through 5 will reduce infiltration through the soil/fill. The cap would reduce the scope/footprint and time needed to achieve groundwater RAOs by eliminating the soil/fill to groundwater pathway.

- Soil/Fill Alternatives 3 through 5 include the upgrading of the river bulkhead through the installation of approximately 800 feet of sheet piling or riprap to reduce the potential transport of soil/fill containing COCs to surface water. Groundwater Alternative 2 includes the installation of a vertical barrier wall, most likely sheet piling, across the entire river edge so as to reduce the potential migration of shallow fill and deep groundwater to surface water. If the selected remedy includes a vertical barrier wall as part of the groundwater alternative, there would be no need for the bulkhead enhancements described for the soil/fill alternatives, and the overall cost would be reduced accordingly.

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TABLES

Table 6-2: Cost Summary of Remedial Alternatives

Table 6-3: Projected Durations of Remedial Alternatives

FIGURES

APPENDIX A: SOIL/FILL AREA/VOLUME DELINEATION INFORMATION

APPENDIX B: COST TABLES

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